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4 DECEMBER 1986

USSR Report

EARTH SCIENCES

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METEOROLOGY

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SYSTEMS OF COUPLED GYROSTATS IN PROBLEMS OF GEOPHYSICAL HYDRODYNAMICS

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 22, No 7, Jul 86 (manuscript received 28 Jan 85) pp 701-711

[Article by A.B. Glukhovskiy, Atmospheric Physics Institute, USSR Academy of Sciences]

[Abstract] The general requirements on dynamic systems for describing real hydrodynamic phenomena involves use of so-called systems of the hydrodynamic type, finite-dimensional quadratic-nonlinear systems. The simplest of these systems is a triplet, a three-mode system equivalent to the Euler equations of motion of a gyroscope and describing the flow of an ideal incompressible homogeneous fluid within an ellipsoidal cavity. Application of the Galerkin method to problems of the hydrodynamics of an ideal incompressible homogeneous fluid leads to systems of the hydrodynamic type which constitute superpositions of triplets. In the hydrodynamics of an inhomogeneous fluid, as in problems of convection and geophysical hydrodynamics, systems of the hydrodynamic type which in addition to quadratic terms contain linear terms caused by nondissipative factors and therefore are not superpositions of triplets, are characteristic. The objective of this article is to demonstrate that such systems can nevertheless be represented in the form of a superposition of three-mode systems of the hydrodynamic type which like triplets allow a simple hydrodynamic interpretation and which have a known mechanical analogue, being describable by the Volterra equations for the motion of a gyrostat. Among the problems which can be dealt with on this basis are a two-layer quasigeostrophic model of general circulation of the atmospher, a model of convection with double diffusion and a system of coupled Lorenz models arising in the Rayleigh-Benard problem. Figures 3; references 14: 7 Russian, 7 Western.

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CSO: 1865/391

'ERA-1' SONIC DEPTH-FINDER FOR OFFSHORE OIL PROSPECTING

Alma-Ata KAZAKHSTANSKAYA PRAVDA in Russian 21 Aug 86 p 3

[Text] A small, automated sonic depth-finder and recorder, the "Era-1", is effective for topographic studies of the seabed for the purpose of prospecting oil and gas deposits in the coastal shelf. Installed on ships, launches or boats, this instrument measures depths as great as 250 meters.

The instrument's operating principle is based on ultrasonic signals.

Small size and low weight are advantages of the sonic depth finder. It can operate on a storage battery.

The depth finder was developed jointly by the Novosibirsk Electrical Engineering Institute and the Central Scientific Research Institute of Geodesy, Aerial Photography and Cartography.

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PROTRUDING LENSES IMPROVE DEEP-DIVING VEHICLE RESEARCH POTENTIAL

Moscow TASS in English 8 Aug 86

[Text] Leningrad. The phenomenal ability of the hammerhead shark to see all around it without turning its head has prompted Leningrad experts to devise similar optical systems for deep-diving research vehicles.

The outboard lenses they came up with feature so-called protruding pupils and supply 360-degree-angle images to either an observation post or television cameras via fiber light guides.

These devices have been among new developments for submergence laboratories reported at a conference in the ship-building institute here.

CSO: 1865/406-E

LARGER, BETTER-EQUIPPED, DEEPER-DIVING RESEARCH SUBMARINES HAVE BEEN TESTED

Moscow TASS in English 8 Aug 86

[Text] Soviet designers are now in the process of evolving a new generation of research submarines which will be more versatile, better equipped and more comfortable, and boast larger cruising capacities and diving depths than their predecessors.

The new "OSA-3-600", "Bentos-300" and "Argus" hydrospace craft, which are meant to study the sea shelf, including its biological, geological and hydrochemical characteristics, have already gone through their first experiments.

The "Shelf-1" and "Osmotr" vehicles allowing resident divers to go outside at large depths are undergoing tests in the Far Eastern Seas.

A new subaqueous module which can serve as a home for six researchers and is called "Chernomor-3" is also being tried out.

Underwater automatic systems and robots are also indispensable in studying ocean resources. One of such systems, which has a power-driven wheel landing gear and a telemetry facility and is called "Krab", has already made a series of experimental dives and showed itself to be highly reliable and efficient.

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JOINT ATLANTIC EXPEDITION WITH FRENCH COVERS 20,000 MILES

Moscow TASS in English 1832 GMT 7 Jul 86

[Text] Moscow. The processing of the findings of a scientific expedition aboard the "Academik Boris Petrov" has been completed. "French scientists were working side by side with Soviet researchers in that multi-month sea journey," Leonid Dmitriyev, head of the laboratory of the V.I. Vernadskiy Institute of Geochemical and Analytical Chemistry of the USSR Academy of Sciences, says in an article written for TASS.

The main task of the expedition was to collect samples of volcanic basalt which form the foundation of the oceanic crust on the slopes of a major underground mountain ridge, stretching across the Atlantic from the Arctic almost all the way to the Antarctic. Another task was to take samples of oceanic water from the surface to the bottom along the axis of the ridge to test them for signs of active sources of hot solutions around which deposits of copper, zinc, lead, tin and ohter sulfides are formed. Studies by Soviet scientists indicated that such deposits ought to be found on the ocean floor. By chance they were discovered by French researchers.

The expedition coped with the program successfully. It covered more than 20,000 miles in four months, took more than 4,500 tons of samples and analyzed them. From new sites with obvious signs of active hot springs were discovered. Not more than 10 such sites are known in the Atlantic today.

The success of the expedition was made possible in large measure by the contribution of well-known French scientists from the Bretanny Oceanographic Center and staff members of the Paris Institute of Earth Physics.

Most of the findings have now been studied.

The "Academik Boris Petrov" has now left on another research mission. The participants in the current expedition aboard the vessel will study the eastern slope of the ridge, where a huge deep-water fissure piercing the African continent originates.

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CSO: 1865/385-E

'KOSMOS-1766' SATELLITE FOR OCEAN STUDIES LAUNCHED

Moscow IZVESTIYA in Russian 30 Jul 86 p 3

[Text] TASS announcement--An artificial earth satellite, "Cosmos-1766", was launched from the Soviet Union on 29 July 1986.

The main task of the satellite is to obtain oceanographic information quickly for various brnaches of the USSR's economy and in the interests of international cooperation, and also to continue the perfecting of new types of measuring apparatus and methods for remote studies of the earth's surface and atmosphere.

The satellite was placed into an orbit with the parameters: apogee--679 kilometers; perigee--648 kilometers; orbit inclination--82.5 degrees; initial period of revolution--97.8 minutes.

Sets of scanning, optical-mechanical and radiophysical apparatus are installed on board the satellite. The State Scientific Research Center for the Study of Natural Resources and independent receiving posts of the State Committee for Hydrometeorology and Monitoring of the Natural Environment are receiving information from the satellite for processing and dissemination.

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CSO: 1865/384

ASIANS, AMERICANS PARTICIPATE IN FIRST PACIFIC SYMPOSIUM ON SEA SCIENCES

Moscow Television Service in Russian 1235 GMT 13 Aug 86 (from the "Novosti" newscast)

[Text] Scientists of the Soviet Union, the United States, China, Japan and South Korea have decided to intensify joint work on investigating the resources of the Pacific Ocean, and place them at the service of mankind. They took part in the first Pacific symposium on sea sciences. It ended today in Nakhodka. The discussions of the specialists were fruitful. Praccical steps have been outlined for joint work, in particular, marine expeditions by Soviet and Chinese scientists will be organized, and the efforts of researchers of the Pacific Ocean will be coordinated in the name of the social progress of the states of the region. The theme of the next symposium will be the rational use of ocean resources.

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CSO: 1865/393-E

ATLANTIC OCEAN DEPTHS STUDIED

Moscow TASS in English 21 Jun 86

[Text] Moscow. A giant lens of heterogeneous water has been discovered by Soviet oceanologists in Atlantic Ocean depths. It is 55 kilometers long in diameter and its depth in the middle section is 1,300 meters. Scientists found the lens during expeditions aboard the ships "Akademik Mstislav Keldysh", "Akademik Kurchatov" and "Vityaz" which explored the Atlantic Ocean for a month in summer 1985.

It turned out that the lens is moving northwestward at a daily speed of 2.4 kilometers. The water in the lens is warmer than the surrounding water by five degrees, on the average. With respect to its salt content it is close to Mediterranean water.

The USSR Academy of Sciences regularly sends expeditions to different parts of the world ocean within the framework of the national project "Razrezy" ("Sections"). The task of the expeditions is to study the role of the oceans in brief fluctuations of climate. The project provides for more than 20 expeditions a year.

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MAGNETIC TEST AREA IN BLACK SEA

Leningrad TASS in Russian 18 Jul 86 1854 gmt

[Text] Leningrad. The first experimental maritime meteorological test area in world science will be established in the Black Sea from aboard the engine- and sail-powered schooner "Zarya". The only completely nonmagnetic vessel in the world, under the flag of the USSR Academy of Sciences, today set off on its 29th scientific voyage.

"The Black Sea experiment aims to conduct in the waters between the shores of Bulgaria and the USSR a series of magnetic measurements which are so precise that their accuracy will be ten times greater than those generally made," explained the scientific director of the work, Yevgeniy Roze of the Leningrad Section of the Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation (Izmiran). The readings of the on-board apparatus of the "Zarya", the simultaneous data of shore-based Soviet and Bulgarian geophysical stations, and information received from space will be used in this.

The magnetic test area in the Black Sea will thus beoome a standard for checking new methods, equipment and apparatus. This was envisaged by the joint program of the Academies of Sciences of the CEMA member countries".

Whilst floating around Europe, Yevgeniy Roze added, the Soviet scientists will carry out passing observations on the state of the magnetic pole of the planet. The Aegean Sea, where two years ago an expedition on the "Zarya" discovered curious magnetic anomalies, is of particular interest for them.

As specialists presume, studying them may throw light on contentious issues concerning the past and the future of the whole Mediterranean basin. The supporters of one of the hypotheses consider that this is the remnant of an ancient ocean "squashed" by the plates of Europe and Africa. Others, on the other hand, see the Mediterranean as being a future oceanic depression. "The magnetic memory" of the sea-bed will help to reconstruct the details of its geological history.

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RESEARCH SHIP 'SAMOYLOVICH' COMPLETES BALTIC CRUISE

Leningrad LENINGRADSKAYA PRAVDA in Russian 23 Jul 86 p 1

[Article by A. Kozlovskiy]

[Text] Tomorrow, the 'Rudolf Samoylovich,' a scientific research vessel of the Arctic and Antarctic Scientific Research Institute, returns to its home port from a cruise that lasted a month and a half.

The main task which the vessel's expeditionary crew faced was to study the variability of hydrological, hydrochemical and hydrobiological parameters of ecological systems of the southwestern and central parts of the Baltic Sea. Much attention was devoted in this connection to the exchange of water between this sea and the North Sea Basin through the Baltic straits; this task was dictated by questions of designing and building water-engineering installations in the waters of the Baltic.

The questions faced by the scientists required that they perform a whole complex of scientific studies at several points on the sea simultaneously. Vessels belonging to the Estonian Academy of Sciences and the Estonian and Latvian Administrations for Hydrometeorology and Monitoring of the Natural Environment therefore took part in the expedition, as did an IL-18 laboratory airplane of the Leningrad Branch of the Oceanology Institute.

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GUINEAN COASTAL SHELF STUDIED FROM RESEARCH SHIP 'KOLESNIKOV'

Kiev PRAVDA UKRAINY in Russian 22 Aug 86 p 4

[Article by Ye. Guzhva]

[Excerpt] An expedition of the Ukrainian Academy of Sciences which conducted studies in the Atlantic Ocean on board the scientific research vessel 'Professor Kolesnikov' has completed its work. Soviet scientists and Guinean specialists continued study of the geological structure of one of the most interesting and little-explored parts of the Atlantic Ocean--the continental margin of the Republic of Guinea, a friend of our country--and of prospects for finding mineral resources there.

We recorded comments of Candidate of Geological and Mineralogical Sciences Yu.N. Demedyuk, scientific secretary of the expedition:

"The expedition, which was headed by Candidate of Geological and Mineralogical Sciences A.Yu. Mitropolskiy, lasted 97 days. The studies of the expedition were confined chiefly to shallow-water, coastal-shelf areas of the Republic of Guinea's economic zone.

"Research carried out during the cruise has a previous history. This work began in 1984, during a cruise of the scientific research vessel 'Akademik Vernadskiy', when specialists of institutes of the Ukrainian Academy's Department of Earth Sciences identified this area as a promising one for finding mineral resources. On the basis of results of this work, the Ukrainian Academy drew up a long-term geological-geophysical program for studying the coastal shelf and slope of the Republic of Guinea. The drafting of the program was initiated by Ye.F. Shnyukov, member of the Ukrainian Academy and director of the Academy's Institute of Geological Sciences, and by V.N. Yeremeyev, director of the Ukrainian Academy's Marine Hydrophysics Institute. The program's ultimate objective is to compile a geological-geophysical atlas of the Republic of Guinea's economic zone. The expedition on board the vessel 'Professor Kolesnikov' was the first serious step toward the compilation of this atlas."

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THICKNESS AND DENSITY OF INDIAN OCEAN SEDIMENTARY COVER

Kiev GEOFIZICHESKIY ZHURNAL in Russian No 3, May-Jun 86
(manuscript received 12 May 85) pp 68-74

[Article by O.M. Rusakov, Geophysics Institute, Ukrainian Academy of Sciences, Kiev]

[Abstract] A study was made of the structure of the sedimentary cover of the Indian Ocean in the light of new information which has recently become available. The major regularities of quantitative distribution of sedimentary material indicate that the maximum thickness is found around the ocean periphery and the minimum thickness in its central area. The thickest sedimentary cover is around the northern edge of the water area. Thicknesses of the sedimentary cover are this correlated with the circumcontinental and natural zonality of the oceans. Variations in density with depth correspond to compacting of the sedimentary cover. A table presents calculated densities of the sedimentary cover for various thicknesses. Results of borehole studies performed by the "Glomar Challenger" indicate that a map of thicknesses can also be used as a map of densities, since density varies directly with thickness. Figures 3; references 17: 8 Russian, 9 Western.

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CSO: 1865/333

UDC 591.524.12(268.4)

SINKING RATE OF FECAL PELLETS OF BARENTS SEA MYSID PRAUNUS INERMIS (RATHKE) DETERMINED IN LABORATORY

Moscow OKEANOLOGIYA in Russian Vol 26, No 3, May-Jun 86
(manuscript received 12 Jun 85) pp 499-504

[Article by Ye.G. Arashkevich, G.M. Vinogradov and T.N. Semenova, Oceanology Institute imeni P.P. Shirshov, USSR Academy of Sciences, Moscow]

[Abstract] Fecal pellets of different forms of zooplankton play a major role in the vertical transport of organic and inorganic matter. The rate of

their sinking is one of the parameters determining this flux of matter. The rate of sinking is an aqueous medium is a function of their size and density, viscosity and density of the medium itself. The rate of sinking of fecal pellets of different size from the mysids Praunus inermis (Rathke) was studied under laboratory conditions. The rate of sinking was also determined for pellets of different "age" exposed at different temperatures. The research was done in August 1984 in the Barents Sea at the Murmansk Marine Biological Institute. The mysids were collected from the rocky bottom at ebb tide. It was found that the rate of sinking, in addition to size, is governed by their content and compactness, factors governed by feeding conditions. With an increase in food concentration the size can increase by a factor of 5-10. In regions where there is a strong terrigenous runoff with a large content of suspended mineral matter which is taken in with food there is a considerable increase in pellet sinking rate. These and other factors must be taken into account in ascertaining the flow of detrital matter included in the fecal pellets. An expression is derived for the rate of sinking of pellets as a function of size at a given temperature and as a similar function of their "age," as well as an expression for the dependence of the sinking rate on pellet volume. Figures 3; references 11: 1 Russian, 10 Western.

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UDC 551.463

COMPARISON OF EQUATIONS OF STATE OF SEAWATER (KNUDSEN-EKMAN EQUATION AND INTERNATIONAL EQUATION OF 1980)

Moscow OKEANOLOGIYA in Russian Vol 26, No 3, May-Jun 86
(manuscript received 11 Dec 84) pp 505-513

[Article by O.I. Mamayev, Moscow State University imeni M.V. Lomonosov]

[Abstract] The Knudsen-Ekman classical equation for the state of seawater, long in use by Soviet and foreign oceanographers, is being replaced by the International Equation of State of Seawater of 1980. Five conversion tables are given. It is shown that the difference in seawater density computed using these equations is determined, disregarding old and new measurement methods, by the difference in the reference value (standard) for the maximum density of pure water. In the new equation this parameter has been assigned the value 0.999 975 g/cm^3, whereas in the classical equation the value 1.000 000 g/cm^3 was assumed. It is also determined by the difference in salinity scales, that which has been used until now, and the Practical Salinity Scale of 1978, which is used in conjunction with the new equation. The reference tables and graphs accompanying the test give a comparison of densities calculated by the old and new equations of state for different temperatures, salinities and hydrostatic pressures. For atmospheric pressure the correction of Knudsen data in the range of oceanic salinities,

for their reduction to the new data, essentially involves subtraction of a systematic error, equal to 0.025 (g/cm^3 - 1), from "sigma-T." In the region of increased pressures the correction to density can be determined from a special graph. In the last analysis, the difference in density gradients determined from the old and new equations of state is insignificant. Figures 3; references 21: 6 Russian, 15 Western.

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UDC 621.396+528.8

CONTRAST-BACKGROUND SENSITIVITY OF PANORAMIC RADAR AND SONAR SYSTEMS

Moscow OKEANOLOGIYA in Russian Vol 26, No 3, May-Jun 86
(manuscript received 2 Apr 84) pp 521-527

[Article by V.V. Lobytsyn, Yu.I. Lomonosov and S.V. Pereslegin, Oceanology Institute imeni P.P. Shirshov, USSR Academy of Sciences, Moscow]

[Abstract] A study was made of the discrimination of contrasts at the ocean surface and floor by use of the methods traditional for statistical radio engineering. The statistical approach to the discrimination of contrasts makes it possible to evaluate correctly the capabilities of existing panoramic apparatus, to clarify the capabilities of such apparatus as might be designed especially for the discrimination of contrasts and to suggest some technical means for achieving these goals. A knowledge of the capabilities of panoramic radars and sonars is also required for proper planning of their use in oceanological experiments. Methods are proposed for the optimum discrimination of objects, features and phenomena on the basis of intensity contrasts of the received signals when receiver noise is present. The concept of contrast-background sensitivity of panoramic radars and sonars is introduced. The results are then applied to side-scan radars and sonars used on oceanology. The required formulas are derived, the theory is fully explained and the parameters of presently used radars and sonars are used in illustrating their contrast-background sensitivity. The method, however, requires reliable information on the characteristic levels of contrast which are caused by different phenomena at the surface and bottom; special research is required for preparation of such keys. Figures 3; references 18: 13 Russian, 5 Western.

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UDC 551.460.18(265)

FOURTH CRUISE OF SCIENTIFIC RESEARCH SHIP 'AKADEMIK ALEKSANDR NESMEYANOV' IN NORTHWESTERN PART OF PACIFIC OCEAN (28 JUNE-21 OCTOBER 1984)

Moscow OKEANOLOGIYA in Russian Vol 26, No 3, May-Jun 86 pp 537-539

[Article by B.I. Vasilyev]

[Abstract] Geological and geophysical research was carried out from the "Akademik Aleksandr Nesmeyanov" in the northwestern part of the Pacific Ocean, in the Philippine and South China Seas during the period 28 June-21 October 1984. The main objective was study of the second and third layers of the oceanic crust in the abyssal trenches and in underwater rises and seamounts. Emphasis was on dredging. A map shows the track of the vessel and work areas. Dredging was carried out at 72 stations, sediments were sampled by other methods at 25 other stations, underwater photographs were taken at 12 stations, depth measurements were made for a distance of 13,374 miles, magnetometric measurements for a distance of 9,615 miles and gravimetric measurements for a distance of 9,734 miles. Work in each area is described. For example, two seamounts were studied in the central part of the Shatskiy Rise. Pillow lavas of alkaline and subalkaline basalts formed under shallow-water conditions were dredged up. The basalts were covered by psammitic tuffs of andesites of a series characteristic for island arcs. The basalts have been modified by metasomatic processes, locally transformed into baritic-phosphatic rocks, evidently caused by their association with a deep fault zone. Two rock complexes were dredged up from the southeastern part of the Central (Taiwan) fault in the Philippine Sea, such as metamorphosed tholeiitic basaltoids, dolerites, gabbroids, apohyperbasites, and others in the first complex and slightly modified tholeiitic basaltoids in the second. These and other data are indicative of a highly complex geological structure of the abyssal trenches and submarine rists in this part of the Pacific Ocean and Philippine Sea not fitting in to the existing models of ocean floor structure in these regions. Figures 1.

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UDC 550.312

DENSITY MODELING OF LITHOSPHERE IN TRANSITION ZONES OF PACIFIC OCEAN TYPE

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA, SERIYA 4: GEOLOGIYA in Russian No 3, May-Jun 86 (manuscript received 23 May 85) pp 81-88

[Article by A.G. Gaynanov, D.A. Gilod and V.R. Melikhov, Moscow University]

[Abstract] Density modeling of the lithosphere in the transition zones of the Pacific Ocean was carried out with an evaluation of the gravitational

effects of plunging high-density lithospheric plates. The modeling was based on published data on parameters of seismofocal zones. It is assumed that the slope θ° of Zavaritskiy-Benioff seismofocal zones and the maximum depth D of earthquake hypocenters characterize the parameters of a high-density plunging plate. In the transition regions of the Pacific Ocean the slope of the seismofocal zones and the maximum depth of earthquake hypocenters have a great variability: $\theta = 15^\circ$-85° and D = 180-700 km. Accordingly, it was necessary to calculate the gravitational effects separately for each of the 38 studied profiles (a map shows the location of each profile, a table gives the pertinent parameters for each, such as amplitude (in mgal) and width of the anomalous zone. Computations were made for three variants: $\Delta\sigma = 0.1, 0.05, 0.02$ g·cm^3. The thickness of the moving and plunging lithospheric plate was considered constant; variants with thicknesses of 80 and 100 km were computed. It was found that the amplitude of anomalies with constant angles θ° increases with an increase in the depth of plate plunging and increases sharply with a decrease in slope θ°. The latter is manifested particularly clearly for plates with small depths D. The width of the anomalous zone increases with a decrease in the angle θ° and an increase in the length of the lithospheric wedge with constant θ°. These and other findings from the gravitational modeling can be used in separating the gravitational influence of high- and low-density blocks of mantle matter and in estimating the excess density of a plunging lithospheric plate. Figures 4; references 28: 13 Russian, 15 Western.

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UDC 577.475(266)

INFLUENCE OF HYDROLOGICAL REGIME ON ZOOPLANKTON DISTRIBUTION ALONG PERUVIAN COAST

Moscow OKEANOLOGIYA in Russian Vol 26, No 3, May-Jun 86
(manuscript received 20 Mar 84) pp 494-498

[Article by A.G. Timonin and M.V. Fint, Oceanology Institute imeni P.P. Shirshov, USSR Academy of Sciences, Moscow]

[Abstract] The distribution of mass species of net zooplankton was determined along the shores of Peru on a section along 8°S under the different hydrological conditions prevailing in the autumn of 1978 and 1982. In March 1978, on the 20th cruise of the "Dmitriy Mendeleyev," a 150-mile run was made from the coast into the ocean through waters occupied by two oppositely directed flows: the narrow (8-10 miles in width) alongshore Peruvian Current, directed to the north, and the Peruvian Countercurrent, lying seaward, with a southerly direction. A different hydrological situation prevalied at this same latitude in February 1982 during the 34th cruise of the "Akademik Kurchatov," during which a flow of northerly direction prevailed in the entire 200-mile zone, with only a narrow southerly

jet at 81°W. The types of water stratification in 1978 and 1982 were identical and differed only withrrespect to position of the boundaries relative to the coast. In both cases the composition of zooplankton in the studied 200-300-mile zone was much the same, but a comparison of the distribution of 40 mass species of copepods, euphasiids and chaetognaths in the "warm" and "cold" periods (1978 and 1982 respectively) revealed considerable differences with respect to the boundaries of distribution of the species and the age structure and vertical distribution of dominant forms. Three different groups of species could be differentiated: those expanding the limits of their habitat with intensifcation of the influence of warm tropical waters from the northwest on the Peruvian coastal region; those preferring the cold waters of the Peruvian Current; those indifferent to a change in hydrological conditions. Since the reaction of the main components of zooplankton to habitat conditions is now known, it will be possible to predict the state of zooplankton in the investigated waters as a function of hydrometeorological conditions. Figures 1; references: 10 Russian.

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UDC 551.456.11

BOUNDARY VALUE PROBLEM FOR SEA SURFACE TOPOGRAPHY IN SEA CURRENT MODELS

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 22, No 7, Jul 86 (manuscript received 5 Apr 85) pp 757-764

[Article by Yu.L. Demin and R.A. Ibrayev, Computational Mathematics Branch, USSR Academy of Sciences]

[Abstract] A new formulation of the boundary value problem for sea surface topography is proposed. Both the traditional and proposed approaches are examined in the example of a model of equatorial currents. The model used includes primitive equations of motion, the hydrostatics equation and the continuity equation, as well as the boundary value problem for the ocean surface. The formulation is in the form of a Neumann problem, which has a number of advantages over the traditional approach. For example, computation of the level at the basin boundary is not required. Unlike problems for the integral stream function, the problem can be solved identically in both singly and multiply connected regions without complication of the algorithm or increase in the volume of computations. The solubility condition and computation method are fully described. The method was used in computing currents in the equatorial (7.5°N-7.5°S) Atlantic. The same nonlinear model was employed as by Yu.L. Demin, et al. in J. MARINE RES., Vol 35, No 2, pp 339-356, 1977, but the Neumann, not the Dirichlet problem was solved. The longitudinal grid interval was 1°, the latitudinal interval varied from 1 to 0.25°; the 15 horizons used were from the surface to 5,000 m.

An implicit difference scheme was used with the approximation of nonlinear terms by directed differences. In each fixed time interval the solution of the difference equations was found by the upper relaxation method. The results are given in several figures. Comparison with solution by the Dirichlet method revealed the great superiority of the new approach. Figures 3; references 13: 8 Russian, 5 Western.

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UDC 551.56/58:621.72(260)

MODEL OF WORLD OCEAN CLIMATE

Moscow OKEANOLOGIYA in Russian Vol 26, No 3, May-Jun 86
(manuscript received 2 Jul 84, after revision 18 Dec 84) pp 357-364

[Article by M.Ya. Verbitskiy and D.V. Chalikov, Leningrad Division, Oceanology Institute imeni P.P. Shirshov, USSR Academy of Sciences]

[Abstract] The configuration of the oceanic basins plays a decisive role in the formation of planetary climate. The climatic model of the ocean proposed earlier by the authors (IZV. AN SSSR: FIZ. ATMOSF. I OKEANA, Vol 18, No 10, pp 1011-1017, 1982) has now been improved by incorporation of a simulation of real planetary morphology. This new model of the world ocean represents the three main oceans and the Arctic and Antarctic Oceans connected to them; the three main oceans have different angular widths but a constant depth. This idealized distribution of land and sea gives an entirely satisfactory approximation of the latitudinal distribution of continental land masses. Many features of global circulation of oceanic waters are represented. For example, there are clearly expressed anticyclonic circulations in the upper layer of the ocean in the northern and southern hemispheres and movement has the opposite direction in the lower layer. Water subsidence occurs in the polar regions and upwelling in the subequatorial and temperate latitudes. The orders of magnitude of flows correspond to empirical data. The new model occupies an intermediate position in the family of models of oceanic climate. In detail it is superior to all approaches used earlier in simple climatic models. Although it does not reproduce the three-dimensional structure of geophysical fields, in an idealized form it gives the fundamental elements of oceanic circulation and takes geography of the ocean into account. The model can be used in reproducing the long-period evolution of climate within the framework of the three-component ocean-atomsphere-ice system. Figures 4; references 14: 9 Russian, 5 Western.

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UDC 551.463:551.508.9

REACTION OF OCEAN-ATMOSPHERE SYSTEM TO DOUBLING OF ATMOSPHERIC CO_2 CONTENT AND ITS SEASONAL VARIABILITY

Moscow OKEANOLOGIYA in Russian Vol 26, No 3, May-Jun 86
(manuscript received 23 May 84) pp 365-375

[Article by B.A. Kagan, V.A. Ryabchenko and A.S. Safray, Leningrad Division, Oceanology Institute imeni P.P. Shirshov]

[Abstract] The seasonal variability of reaction of the ocean-atmosphere system to a doubling of the content of atmospheric CO_2 is evaluated. The point of departure is the thermodynamic model of seasonal evolution of the ocean-atmosphere system proposed by the authors in IZV. AN SSSR: FIZ. ATMOSF. I OKEANA, Vol 19, No 5, pp 451-458, 1983. Two numerical experiments were carried out, in one of which the CO_2 concentration was assumed equal to its preindustrial level (290 million^{-1}), whereas twice this level (580 million^{-1}) was used in the second. The results of these elaborate calculations are summarized in two lengthy tables. It is shown that the deviations of surface temperature in the high and low latitudes would not differ greatly from one another due to the damping influence of the ocean. Quantitative estimates are given illustrating the important role of the ocean in response of the climatic system to change in external parameters. With direct allowance for the effects of heat transfer in the ocean the mean annual increase in temperature of the atmospheric surface layer caused by a doubling of the CO_2 content for the norther hemisphere would be 0.97 K. In limiting cases (an ocean of zero and infinite heat capacity) it would be 2.07 and 0.16 K. Three-dimensional models of general circulation of the atmosphere, by comparison, give 2.9 and 3.0 K in the first case (Manabe, Wetherald) and 0.2 and 0.16 K in the second (Gates, et al.; Mitchell). References 11: 3 Russian, 8 Western.

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UDC 551.463(263)

PREDICTION OF SYNOPTIC MOVEMENTS IN POLYMODE REGION USING BAROTROPIC MODEL

Moscow OKEANOLOGIYA in Russian Vol 26, No 3, May-Jun 86
(manuscript received 16 Apr 85) pp 376-381

[Article by V.M. Kamenkovich, Yu.M. Grachev and B.V. Kharkov, Oceanology Institute imeni P.P. Shirshov, USSR Academy of Sciences, Moscow]

[Abstract] A numerical barotropic model for predicting synoptic eddies in the open ocean was developed by the authors in OKEANOLOGIYA, Vol 21, No 5, pp 773-786, 1981; Vol 22, No 5, pp 719-725, 1982. The model has now been

tested by analyzing the results of predictions of the field of synoptic eddies in the region of the POLYMODE experiment for the period 20 April-20 May 1978 using the observed initial field and boundary values. The stream function fields at the horizons 100, 400, 700 and 1,400 m were used; the results of predictions for the first three of these horizons are given. The error in prediction at all horizons varies with time; the maxima and minima of such variations at different horizons are somewhat displaced relative to one another. The stream function fields computed for the 700-m horizon for 5, 15 and 25 days in advance are cited as an example and compared with the observed fields. The analyzed area contained three well-defined eddy formations. Their actual and predicted evolution was compared. Two of these were predicted very precisely, whereas the third was predicted somewhat less successfully. The results of computations for the 100- and 400-m horizons were much the same as for the 700-m horizon. Computations for the 1,400-m level were not really successful. The results of the experiments indicate the possibility of barotropic predictions for individual horizons for times of about three weeks. Figures 4; references 14: 13 Russian, 1 Western.

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HIGHLY NONLINEAR BAROCLINIC SOLITARY ROSSBY WAVES

Moscow OKEANOLOGIYA in Russian Vol 26, No 3, May-Jun 86
(manuscript received 6 Mar 84) pp 382-388

[Article by Z.I. Kizner, All-Union Marine Fishing and Oceanography Scientific Research Institute, Moscow]

[Abstract] In a previously article entitled "Strong Synoptic Eddies in a Quasigeostrophic Approximation," OKEANOLOGIYA, Vol 26, No 1, 1986, the author defined conditions for applicability of the equation for a quasigeostrophic eddy for description of strong synoptic eddies in the first approximation. This earlier study has served as the point of departure for this study (reference to which is necessary for an explanation of the notations) of strong synoptic eddies in which the orbital velocities of the fluid particles are great in comparison with the velocities of "translational" motion. These eddies are modeled as highly nonlinear solitary Rossby waves in a continuously stratified ocean with a constant Brunt-V䁡is䁡l䁡 frequency. The solution of the problem is expanded in power series in the Kibel number. Only the zero and first approximations are examined. It is shown that the zero approximation, with an appropriate choice of horizontal and vertical linear scales, is characterized by spherical symmetry. It is then demonostrated that the conditions of first approximation regularity determine the fundamental characteristics of the zero approximation. Figures 4; references 5: 4 Russian, 1 Western.

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QUASIGEOSTROPHIC THREE-LAYER MODEL OF HYDRODYNAMIC INSTABILITY OF CURRENTS FOR INVESTIGATING EDDY FORMATION CONDITIONS IN WORLD OCEAN

Moscow OKEANOLOGIYA in Russian Vol 26, No 3, May-Jun 86
(manuscript received 4 Jun 84, after revision 25 Dec 84) pp 389-394

[Article by A.S. Blatov, N.S. Rapilbekova and V.I. Ulyanova, Moscow State University imeni M.V. Lomonosov; Computer Center, USSR Academy of Sciences, Moscow]

[Abstract] A linear model of stability of a three-layer large-scale current with weak transverse velocity shear, as is characteristic for the North Trades Current in the Atlantic Ocean, was used in studying the joint influence of the vertical distributions of density and velocity in the ocean. Stability diagrams were constructed for a velocity profile simulating conditions in the open part of the ocean. A system of equations was derived which correctly represents the processes involved in the generation of unstable wave disturbances. The parameters of such wave disturbances are evaluated for the Poligon-70 region. An analysis of observations of currents and the hydrological structure of waters during the Poligon-70 period made it possible to estimate the predominant period of synoptic disturbances T~100 days, a length of wave disturbances λ~480 km and the components of phase velocity of propagation of these disturbances c_x = -5.4 cm/s and c_y = -1.2 cm/s, giving an estimate of absolute phase velocity of 5.5 cm/s. These and other data clearly suggest that the observed unstable wave disturbances are in actuality baroclinic Rossby waves. It appears that the mean climatic hydrological structure of waters in this region did not have adequate reserves of available potential energy for baroclinic instability processes to be able to generate synoptic eddies. The synoptic eddy formations observed there probably are attributable to a superposition of planetary waves which might have been propagated from the Canaries Current region. Figures 3; references 14: 9 Russian, 5 Western.

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SPATIAL VARIABILITY OF THERMAL STRUCTURE OF OCEAN ACTIVE LAYER DURING PASSAGE OF SYNOPTIC EDDIES

Moscow OKEANOLOGIYA in Russian Vol 26, No 3, May-Jun 86
(manuscript received 28 Jun 85) pp 395-401

[Article by B.N. Filyushkin, Oceanology Institute imeni P.P. Shirshov, USSR Academy of Sciences, Moscow]

[Abstract] Maps of the spatial variability of the principal characteristics of the active layer of the ocean (thickness of the upper homogeneous layer, its temperature, lower boundary of the seasonal thermocline and the temperature gradient in the thermocline) were plotted. The data used were from temperature surveys of the region of the POLYMODE experiment (June 1977-August 1978). For example, in a period of a weakly expressed seasonal thermocline, when the vertical temperature gradients are small, the topography of H_0 thickness of the upper quasihomogeneous layer) poorly reflects the dynamic picture of the region. When there are great vertical temperature gradients and even a small thickness of the upper quasihomogeneous layer, the entire layer of the seasonal thermocline is usually subject to the effect of currents generated by passing eddies. The H_{low} (depth of the lower boundary of the seasonal thermocline) value at all seasons of the year therefore better reflects the dynamics of waters in the region. The thickness of the seasonal thermocline is a useful parameter because with the upwelling of waters at the center of a cyclone its thickness is always less than during the subsidence of waters at the center of an anticyclone. The thickness of the seasonal thermocline in a cyclone varies from 60 to 100 m, but in an anticyclone from 100 to 160 m, which makes possible approximate identification of the position and type of synoptic eddies. It is shown that analysis of thermal structure of the active layer of the ocean reveals a definite evolution of its parameters during the passage of eddies which has a definite correlation with instrumental measurements of currents made at the same time. Figures 1; references 13: 11 Russian, 2 Western.

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DISPERSION NATURE OF SECONDARY WAVES IN SURF ZONE

Moscow OKEANOLOGIYA in Russian Vol 26, No 3, May-Jun 86
(manuscript received 9 Jul 84, after revision 30 Oct 84) pp 423-426

[Article by S.Yu. Kuznetsov and N.S. Speranskiy, Oceanology Institute imeni P.P. Shirshov, USSR Academy of Sciences, Moscow]

[Abstract] The repeated collapse of waves in the surf zone was studied. Collapse usually occurs on underwater ridges. After each such collapse the wave retains its individuality and continues shoreward. Final collapse occurs at the waterline. In some cases a doubling of the wave crest occurs in the trough between ridges and conspicuous secondary waves are formed which advance shoreward more slowly than the system of primary waves. The same picture is observed when waves which are strongly deformed but not yet collapsing pass across a ridge. It was postulated that the nature of secondary effects is related to dispersion phenomena in the field of strongly nonlinear waves. A field study was made to prove or disprove this hypothesis. Measurements were made in a test range along the coast of Bulgaria in the autumn of 1983. Waves were registered by string wave recorders extending along a line perpendicular to the shore. After the surf waves crossed a ridge not only individual secondary waves, but also pairs of new waves appeared in the troughs. The generation of these secondary waves occurred when a wave collapsed over an underwater ridge or when a strongly deformed (but not collapsing) wave passed across the ridge. Secondary waves were not formed when weakly deformed waves passed across a ridge. No secondary waves were detected seward of the collapse zone. The phase velocity of the secondary waves is less than the phase velocity of the primary waves. The phase velocity of the harmonics decreases with an increase in frequency. Dispersion occurs in the trough, although it is manifested more weakly than predicted by linear theory. Figures 3; references 5: 4 Russian, 1 Western.

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UDC 550.384

MAGNETIC CHARACTERISTICS OF DEEP LAYERS OF OCEANIC CRUST AND STRUCTURE OF ANOMALOUS MAGNETIC FIELD IN OCEAN

Moscow OKEANOLOGIYA in Russian Vol 26, No 3, May-Jun 86
(manuscript received 6 Mar 84, after revision 22 May 85) pp 446-450

[Article by Ye.A. Nazarova and A.M. Gorodnitskiy, Oceanology Institute imeni P.P. Shirshov, USSR Academy of Sciences, Moscow]

[Abstract] A study was made of the magnetic characteristics of rock samples from deep layers of the ocean crust obtained by deep drilling on several cruises of the "Glomar Challenger" and dredging in the equatorial Atlantic. An analysis of these rocks revealed that serpentinized peridotites are characterized by quite strong and stable magnetization comparable to the magnetization of basalts of the second layer. Like basalts, they have the necessary magnetic characteristics for being sources of magnetic anomalies. On the other hand, fresh cumulative gabbros and amphibolitized and serpentinized gabbros of layers 2B and 3A cannot be sources of magnetic anomalies. Peridotites in layer 3B, with serpentinization, as a result of formation of secondary magnetite, acquires a chemical magnetization which is strong and stable in direction. The nature of distribution of I_n for drilled and dredged serpentinites is similar, clearly suggesting that they have a common genesis. Unfortunately, there is no adequate serpentinite model of the magnetically active layer in the ocean crust. Much additional experimental and theoretical work is required for clarification of the serpentinization of peridotites. Figures 1; references 12: 7 Russian, 5 Western.

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SEDIMENTARY STRUCTURE OF CENTRAL BASIN IN PACIFIC OCEAN

Moscow OKEANOLOGIYA in Russian Vol 26, No 3, May-Jun 86
(manuscript received 30 Jan 84, after revision 28 Dec 84) pp 451-459

[Article by G.A. Semenov, O.V. Levchenko, V.N. Moskalenko and P.N. Kuzmin, Oceanology Institute imeni P.P. Shirshov, USSR Academy of Sciences, Moscow]

[Abstract] Continuous seismic profiling was carried out in the Central Basin of the Pacific Ocean during the 28th cruise of the scientific research ship "Dmitriy Mendeleyev." The studied areas were work ranges 5 and 7 directly to the northeast of the Magellan Rise. The sounding profiles were used in constructing maps of the thickness of the sedimentary

layer and relief of the acoustic basement. Drilling data were used in the interpretation of the results. The findings for each of the work ranges are given in detail. Despite a general similarity of the structure of the sedimentary layer in both work ranges, there are distinct differences. The first is located within the limits of an abyssal plain with a depth of about 6 km, characterized by gentle bottom relief. The thickness of the sedimentary layer remains approximately constant at 175-200 m. The simple two-layer section of the sedimentary layer is evidently typical for the abyssal basins in the western part of the Pacific Ocean. The second work range is characterized by a greater bottom and basement dissection. The more complex section of the sedimentary layer and considerable variations of its thickness, from 25 to 350 m, may be caused by erosional and accumulative processes operative here. Such findings can be used in studying the origin and distribution of ferromanganese nodules which occur extensively in the studied region (approximately 172-175°W). Figures 6; references 7: 4 Russian, 3 Western.

5303/9835
CSO: 1865/377

UDC 581.526.321(262.5)

SIZE STRUCTURE OF PHYTOPLANKTON IN WESTERN BLACK SEA DURING SUMMER

Moscow OKEANOLOGIYA in Russian Vol 26, No 3, May-Jun 86
(manuscript received 21 Mar 84, after revision 11 Dec 84) pp 474-480

[Article by D.A. Nesterova, Odessa Division, Biology of Southern Seas Institute, Ukrainian Academy of Sciences]

[Abstract] The northwestern part of the Black Sea has experienced considerable anthropogenic effects during the last decade. This has resulted in significant changes in the species composition and dynamics of phytoplankton in these shallow waters. These changes are particularly well expressed during summer. Pollution is resulting more and more in a predominance of cells of smaller sizes. The size structure of phytoplankton has therefore been reexamined. Phytoplankton samples were collected on the 97th cruise of the "Miklukho-Maklay" at 22 stations in this area in July-August 1980. Samples were taken from the surface tension layer with a thickness of 200 μm, at a depth of 0.5 m, over the upper boundary of the thermocline and at the horizons 25 and 50 m and in places, at the bottom. A total of 120 samples were collected and analyzed. Six size groups were distinguished: less than 1,000, 1,000-5,000, 5,000-10,000, 10,000-30,000, 30,000-60,000 and more than 60,000 μm^3. On the northwestern shelf most (71.3%) of the biomass consisted of small phytoplankton (1,000-5,000 μm^3). In the remaining part of the studied area algae of large sizes (10,000 - > 60,000 μm^3) dominated (61.7%) in the biomass. With respect to vertical distribution, small algae predominated in the surface horizons of the sea,

whereas large phytoplankton predominated at a depth of 10-50 m. The observed development of small algae in the northwestern part of the sea is indicative of the eutrophication of that area. Figures 2; references 14: 13 Russian, 1 Western.

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UDC 551.214:577.475(261)

FEATURES OF DISTRIBUTION OF ADENOSINE TRIPHOSPHATE CONCENTRATIONS OVER ATLANTIC OCEAN SEAMOUNTS

Moscow OKEANOLOGIYA in Russian Vol 26, No 3, May-Jun 86
(manuscript received 3 Feb 84) pp 487-493

[Article by A.S. Lopukhin, Biology of Southern Seas Institute, Ukrainian Academy of Sciences, Sevastopol]

[Abstract] ATP (adenosine triphosphate) concentrations in microplankton in the neighborhood of volcanic seamounts in open regions of the Atlantic (depths of peaks--20-1,000 m) were determined. An effort was made to explain the influence of sea floor relief on the nature of this distribution. The research areas differed considerably with respect to geomorphology, depths of peaks, location in different climatic zones and hydrodynamic conditions. The data were collected on the 11th and 13th cruises of the "Professor Vodyanitskiy" in 1981 and 1982. The waters over 12 such peaks were studied at latitudes ranging from 53°N to 27°S. More than 1,000 analyses of microplankton ATP were made in combination with other hydrobiological studies. Observations over three seamounts are described in detail. In each case there was a domelike zone which for some reason was impoverished with microplankton. Regardless of the depths of the peaks such a zone was limited to the layer 60-200 m above them, not reaching the surface. It is postulated that a Taylor column gives rise to a sort of hydrodynamic "backwater" above such peaks, limited by the stratified upper layer of the ocean. Due to this backwater a local upwelling of waters of low productivity occurs, resulting in formation of a domelike zone of reduced microplankton concentrations. On the other hand, beyond the limits of the Taylor column there is an upwelling of deep waters with the transport of biogens into the photosynthesis zone along the seamount sides, giving rise to maximum microplankton concentrations. Figures 4; references 14: 9 Russian, 5 Western.

5303/9835
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UDC 528.47:528.93

SOME ASPECTS OF COMPILATION OF TOPOGRAPHIC MAPS OF RESERVOIRS

Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 7, Jul 86 pp 47-49

[Article by T.N. Smirnova]

[Abstract] The topographic maps of reservoirs which are now compiled by standard methods are quite inaccurate due to the inadequacy of cartographic and textual source materials and ineffective methods for surveying changes which have taken place subsequent to reservoir filling: slow changes in bottom relief due to sedimentation, significant modification of flooded forest and scrub, appearance of underwater vegetation, formation of peat islands. It is proposed that surveys by upgraded by use of scanning and search sonar techniques. Such work is exemplified using materials from such a survey of the Tsimlyansk Reservoir, accompanied by a comparison with the results of use of less sophisticated methods for surveying that same water body, all using the same survey scale and the same map base. The sonar-prepared maps provided a greatly enhanced and more reliable product with respect to mapped underwater features and shoreline different variants of hydrological surveying, including echo sounding, failed to discriminate much detail. For example, sonar could reliably distinguish the boundaries of different types of bottom material. Although additional labor input is required, the results justify the cost and a much more informative and accurate map is produced. Figures 2; references: 4 Russian.

5303/9835
CSO: 1865/380

UDC 552.124.4:553.32(261.67)

MANGANESE MICRONODULES IN BRAZILIAN BASIN OF ATLANTIC OCEAN

Kiev DOKLADY AKADEMII NAUK URKAINSKOY SSR, SERIYA B: GEOLOGICHESKIYE, KHIMICHESKIYE I BIOLOGICHESKIYE NAUKI in Russian No 5, May 86 (manuscript received 22 Aug 85) pp 5-8

[Article by K.S. Krasovskiy, Geological Sciences Institute, Ukrainian Academy of Sciences, Kiev]

[Abstract] Very little is known of the manganese micronodules of abyssal deposits in the Brazilian Basin, although their widespread occurrence is well established. Virtually nothing is known of their size, morphology or elemental composition. The article gives the results of study of a core of bottom sediments with a length of 490 cm raised from a depth of 5,311 m on the 23d cruise of the "Akademik Vernadskiy." The sediments in general were uniform abyssal clayey ooze. Individual Mn micronodules were encountered in a series of intervals in this core. The size of the micronodules

is usually fractions of a millimeter (the largest was up to 2.5 mm). Five different configurations were encountered: elongated tubular; angular, of irregular shape; flat, with a rough surface; convexoconcave fragments of hollow tubes; 5) manganized foraminifera. The trace element composition of these micronodules is tabulated for 12 samples from the core. The micronodules contain anomalously high contents of Ni, Cu, Mo, Tl and Zn, but their distribution in the core is not uniform. Ni is important in the first layer, Ni, Cu and Mo in the second, Zn in the third and Tl in the fourth. The nonuniform distribution of these elements may indicate that they were initially accumulated by some microorganisms; their elongated tubular form may also indicate a biogenous origin. The high Ni content may be attributable to incorporation of cosmogenic particles. In addition, endogenous matter may be received from the Mid-Atlantic Ridge, which is not far away. Figures 2; references 6: 5 Russian, 1 Western.

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CSO: 1865/367

UDC 551.464.32:551.35

SILVER IN PACIFIC OCEAN FERROMANGANESE NODULES

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 289, No 1, Jul 86 (manuscript received 27 Jan 86) pp 189-192

[Article by G.N. Baturin and V.N. Oreshkin, Oceanology Institute imeni P.P. Shirshov, USSR Academy of Sciences, Moscow]

[Abstract] The range of silver concentration in ferromanganese formations in the Pacific Ocean was determined by a study of 80 samples of nodules and ore encrustations recovered in the Northeast and Central Basins and from the Mid-Pacific Seamounts on the 43rd and 48th cruises of the "Vityaz." Data were analyzed separately for the outer encrustations, mineralized nuclei, upper and lower layers. Silver content was determined by the flame atomic absorption method using a special electrothermal atomizer with independent optimization of the temperature regime in the evaporation and atomization zones, making it possible to detect silver concentrations to 5 mg/ton. The size of the sample was found to be critical in making accurate determinations. Fe and Mn determinations were made in these same samples by classical chemical analysis methods. The Ag content (in mg/ton) was as follows: in gross samples--20 to 260, averaging 90; in ore encrustations--from 30 to 450, averaging 110; in mineralized nuclei--from 15 to 90, averaging 45; in ore encrustations from the surface of basalts and hyaloclastites from seamounts--15 to 220, averaging 90. Conclusions were also drawn concerning the relative contents of gold and silver in ocean sediments and ore formations. The Ag:Au ratio in the crust averages 16.3:1, in sedimentary rocks--100:1, in abyssal oceanic sediments--37:1, in Fe-Mn nodules--30-45:1. The source of both metals in nodules is the

sediments surrounding and underlying them, not sea water. Figures 1; references 15: 10 Russian, 5 Western.

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CSO: 1865/386

UDC 550.848.8

PETROLEUM- AND GAS-FORMATION SCALES IN PERSIAN GULF SEDIMENTARY BASIN

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 289, No 1, Jul 86 (manuscript received 6 Jun 85) pp 204-207

[Article by A.A. Geodekyan, corresponding member, USSR Academy of Sciences, V.Ya. Trotsyuk and M.M. Serdobov, Oceanology Institute imeni P.P. Shirshov, USSR Academy of Sciences, Moscow]

[Abstract] At present it is not fully understood why such extraordinary quantities of petroleum and gas have formed in the Persian Gulf sedimentary basin. This is probably because emphasis has been on study of its structural geology, without attention to quantitative investigation of the functional aspects of genesis and accumulation of hydrocarbons. The authors have applied the historical-genetic method for comparative evaluation of probability of finding petroleum and gas deposits in a sea area, an approach used successfully for studying geologically diverse areas of the ocean. Step-by-step study of the geological history served as a basis for discriminating zones differing significantly with respect to sedimentation, lithological composition, content of organic matter and temperature regime (factors most important in petroleum- and gas-generation potential). Evolution of centers of petroleum and gas formation and stable zones of accumulation were ascertained. The computed densities of generation of hydrocarbons in the Persian Gulf Basin were considerably greater than in other basins with an equal thickness of the sedimentary section. It was found that all aspects of the sedimentary-migration origin of petroleum and gas are clearly exemplified in this region. Over the course of about 500 million years enormous quantities of micropetroleum and hydrocarbon gases were formed in large centers entirely adequate for the formation of the exceedingly great petroleum and gas reserves observed there. Figures 1; references 12: 7 Russian, 5 Western.

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CSO: 1865/386

UDC 528.71:551.463.22

DETERMINING SPEED OF SOUND IN WATER FROM HYDROLOGICAL DATA

Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 7, Jul 86 pp 45-47

[Article by S.L. Kramarenko]

[Abstract] In topographic surveys of reservoirs by the profile method one of the most important range corrections is ΔZ_V for deviation of the mean speed of sound in water from that computed for a particular type of echo sounder. This correction can be obtained from hydrological data by measuring temperature and salinity for water for a given depth and subsequent computation of the speed of sound or by calibration. However, daily calibration requires about 1 hour and sometimes is impossible, making determination of ΔZ_V on the basis of hydrological data necessary. Computation time can be reduced by using materials from long-term hydrological observations. Such observations were used in a survey of the Vilyuy Reservoir, resulting in construction of a graph which could be used in computing the ΔZ_V correction with the required accuracy. The water in this reservoir is poorly mineralized and its salinity is assumed equal to 0. Preparation of reference material involved computation of mean monthly, mean weighted water temperatures $\overline{T}$ for a series of years. These and other data were used in computing the corresponding mean long-term, mean weighted speeds of sound in water $\overline{V}$ and corresponding graphs of its change in time. It was found that the $\overline{V}$ values, tied in to the corresponding date, vary insignificantly for the Vilyuy Reservoir. The $\overline{T}$ and $\overline{V}$ values were computed for the water layers 5, 10, 20, 30 and 60 m and working graphs of $\overline{V}$ change were constructed. In 1983 the speed of sound correction was determined simultaneously by the calibration method and by use of hydrological data. The alternative use of the second method was entirely acceptable and results in a great saving of time and money. Similar graphs and reference tables can be constructed for other water bodies. Figures 2.

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CSO: 1865/380

UDC 550.836(262.81-14)

MARINE GEOTHERMAL RESEARCH ON STRUCTURES OF APSHERON SILL

Moscow GEOLOGIYA NEFTI I GAZA in Russian No 6, Jun 86 pp 61-63

[Article by S.S. Sardarov, S.G. Korniyenko and O.N. Kutuzov, Geothermal Problems Institute, Dagestan Affiliate, USSR Academy of Sciences]

[Abstract] Geothermal surveys of the sea floor at shallow depths are made on the assumption that the thermal regime of the bottom water layer and the

upper sedimentary layer is formed by both endogenous and exogenous factors. The time suited for such research is stipulated and the absence of bottom currents is required. It is assumed that submersion of sensors into the sediments in itself lessens the effect of exogenous interference. The article gives the results of a geothermal survey on the Caspian shelf centered on structures of the Apsheron sill made for a more precise determination of geological structure of petroleum- and gas-bearing formations. The sea depth was 22-78 m; 33 stations were occupied in an area of about 80 km^2. At each station measurements were made of temperature in sediments at a depth of 1 m and at a depth of 4 m, the temperature gradient in sediments in the range 0.4-1 m and bottom water temperature. It was found that the usually stipulated conditions for such surveys are inadequate for such work and that submersion of sensors in the sediments does not necessarily reduce the effect of exogenous noise. This is demonstrated by the specific observations made in this survey. However, at sea depths greater than 100 m the temperature of the bottom water layer can reflect the geological characteristics of a region and in such cases continuous temperature soundings of the floor can be effective in solving geological prospecting problems. Figures 3; references: 2 Russian.

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UDC 001.89

MARINE EXPEDITIONARY WORK OF USSR ACADEMY OF SCIENCES AND ACADEMIES OF SCIENCES OF UNION REPUBLICS

Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 5, May 86 pp 89-96

[Article by L.M. Brekhovskikh, academician, and Ye.M. Kukharkov, candidate of technical sciences]

[Abstract] In the USSR more than 150 institutes and agencies of about 20 ministries and departments are engaged in oceanographic research. Although some such research is carried out from space, most data are collected from expeditionary vessels. The numerous expeditions are carried out within the framework of a unified national plan for expeditionary work. The bulk of this work is done by the ships of the USSR Academy of Sciences, Ukrainian Academy of Sciences and Estonian Academy of Sciences. Their annual plan is prepared by the Commission for Problems of the World Ocean. Some expeditions are carried out within the framework of international programs. The USSR Academy of Sciences has 22 scientific research ships, which together with leased vessels, carried out 69 expeditionary cruises in 1985. There are also 45 vessels with a more limited navigation range. At present the most important research ships are the "Akademik Keldysh," "Akademik Nesmeyanov," "Vityaz," "Akademik Kurchatov" and "Akademik Vinogradov." Smaller ships are in many cases intended for specialized types of research. This fleet was recently supplemented by four ships of 2,600 tons displacement: "Akademik Boris Petrov," "Akademik Nikolay Strakhov," "Akademik M.A. Lavrentyev"

and "Akademik Oparin." The first of these, belonging to the Institute of Geochemistry and Analytical Chemistry, is for geochemical research; the second works under plans prepared by the Geology Institute; the other two vessels belong to the Far Eastern Scientific Center. Underwater vehicles also play an important role, like two of the "Paysis" type which each carry three aquanauts and descend to depths as great as 2 km. Work has now begun on a manned vehicle which will be able to descend to a depth of 6 km. The USSR Academy of Sciences and the Ukrainian Academy of Sciences regularly conduct expeditions under the Soviet national program "Razrezy" ("Sections"), study of the role of the ocean in short-range variations of planetary climate. More than 20 expeditionary cruises are carried out annually under this program. It has been possible to define a number of energy-active zones in the ocean, areas of the most intensive interaction between the ocean and atmosphere. Long-term experiments have been carried out with the artificial earth satellites "Cosmos-1500," "Cosmos-1602," "Intercosmos-20" and "Intercosmos-21," as well as the "Salyut-7" orbital station and scientific research ships. Recently particular attention has been devoted to acoustics research, since it is clear that acoustical methods are such a highly effective tool for oceanological research. The USSR Academy of Sciences and the academies of sciences of the union republics have now formulated a major "World Ocean" program for implementation during the 12th Five-Year Plan. Figures 4.

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UDC 550.311

DEEP SEISMIC SOUNDING OF SUBCRUSTAL LITHOSPHERE IN SOUTH ATLANTIC

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 289, No 2, Jul 86 (manuscript received 10 Jun 85) pp 322-327

[Article by S.M. Zverev, G.A. Yaroshevskaya, Yu.V. Tulina, G.A. Krasilshchikova, N.M. Nardov, V.M. Shablitskiy, O.A. Beresnev, V.K. Illarionov and N.A. Pavlenkova, Earth Physics Institute imeni O.Yu. Shmidt, USSR Academy of Sciences, Moscow]

[Abstract] Studies of the South Atlantic lithosphere were made along deep seismic sounding profiles in 1980-1984 along the Angola-Brazil geotraverse. Self-contained bottom seismic stations were placed at 77 points (in eight sectors) along a line with a total length of 5,000 km. About 400 powerful shots were set off and pneumatic sound sources were activated thousands of times. Data have now been processed for the eastern half of the geotraverse. Systems of counter and overtaking travel-time curves were obtained in all sectors and sections were constructed for all these sectors. There were two sectors with anomalous behavior of the seismic wave field. The most clearly expressed anomaly was in a zone of abyssal hills between 1° and 3°W. The boundaries of the anomalous zone reveal wave indications

of large faults extending for great depths into the mantle. The second anomalous zone is the axial part of the Mid-Atlantic Ridge. In the mantle in this zone there is evidently some special body having either a decreased velocity of propagation of seismic waves or increased absorption. In the studied sector of the South Atlantic crustal structure is everywhere close to typically oceanic. The Moho is at depths of 11-12 km, slightly uplifted toward the axis of the ridge. Velocities are close to 8 km/s in the basin and hill zone and drop somewhat near the ridge axis. In the upper mantle there are two boundaries having velocities of 8.5 and 8.8 km/s situated at depths of 15-20 and 25-33 km. The first boundary has its highest position beneath the basin and in the zone of abyssal hills. A possible petrologic and tectonic interpretation of the data is given and possible explanations for the anomalous sectors are considered. Figures 3; references 6: 2 Russian, 4 Western.

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CSO: 1865/379

UDC 551.466.3

SWELL TRANSFORMATION IN ALGUHAS CURRENT

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 22, No 6, Jun 86 (manuscript received 4 Sep 84, after revision 22 Mar 85) pp 643-648

[Article by Ye.Sh. Gutshabash and I.V. Lavrenov, Leningrad Division, State Oceanographic Institute]

[Abstract] Many cases of ships encountering emergency situations in the Alguhas Current off the southeastern coast of Africa have been reported. These incidents are associated with individual asymmetric waves with a creast of extraordinary steepness preceded by a trough which is longer and deeper than in the case of ordinary wind waves. Such waves attain 15-20 m or more, sometimes even when there is a calm sea. It has been established that in most such cases these waves are associated with a combination of southwesterly swell running from southerly latitudes toward the current and local wind waves generated during the passage of a cold atmospheric front. However, no theory has been formulated to explain this phenomenon. The suggestion that a cold front gives rise to frontal swell waves, which in combination with wind waves give waves of a greater amplitude, cannot fully explain the appearance of the abnormal waves. Still another factor must be considered--swell behavior in the Alguhas Current, a necessary condition for appearance of the largest anomalous waves. The transformation of this swell is examined in the geometrical optics approximation. It is shown that the swell is captured, intensified by a countercurrent and localized in some neighborhood of the maximum velocity, resulting in a concentration in the density of wave energy, resulting in the abnormal waves. Figures 4; references 7: 5 Russian, 2 Western.

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UDC 551.596:551.463.21

AZIMUTHAL DEPENDENCE OF SOUND PRESSURE IN STRATIFIED MOVING MEDIUM

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 22, No 6, Jun 86 (manuscript received 18 Oct 84, after revision 23 Aug 85) pp 634-642

[Article by V.Ye. Ostashev, Atmospheric Physics Institute, USSR Academy of Sciences]

[Abstract] The dependence of sound pressure in a stratified moving medium on azimuthal direction to an observation point is analyzed. The analysis of this dependence is made using newly derived expressions for the sound pressure of a plane wave and a point source situated above an interface. The expressions are derived for sound propagation in the atmosphere but are also correct for other stratified moving media, such as an ocean with currents. A study is first made of observations in the atmospheric surface layer and then in a case when the source and receiver are raised above the earth's surface. In atmospheric acoustics it has been accepted that sound pressure in the direction of the wind is always greater than against the wind. However, the computations presented show that when there is a wind velocity increasing with altitude this is true only when the source and receiver are at the surface. If the source and/or receiver are raised above the earth the azimuthal distribution of sound pressure is more complex. Sound pressure may be maximum in the direction opposite the wind. Figures 3; references 6: 4 Russian, 2 Western.

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UDC 551.21

STRESSES IN UPPER MANTLE OF ACTIVE MARGINS OF OCEAN

Moscow VULKANOLOGIYA I SEYSMOLOGIYA in Russian No 3, May-Jun 86 (manuscript received 17 Dec 84) pp 90-96

[Article received by S.A. Boldyrev, A.B. Yefimov and N.M. Naumova, Earth Physics Institute, USSR Academy of Sciences; Moscow University]

[Abstract] An attempt was made to evaluate the possible stresses arising in the mantle due to lateral density variations without invoking a priori concepts concerning the rheology of mantle matter. The article gives such computations for a case when density variations are determined from data on velocity inhomogeneities of the transition zone from the ocean to the continent of the Pacific Ocean type. The probable source of elastic deformations, expressed as earthquakes, is inhomogeneity of the physicochemical properties of the mantle and accordingly, lateral density variations. It was assumed that density and velocity variations are linearly related. The

basis for the computations was the three-dimensional field of the velocity of P waves in the region taking in the Kurile-Kamchatka island arc and adjacent sectors of the Sea of Okhotsk and Pacific Ocean to depths of 650 km. The greatest velocity changes were at a depth of 150-250 km. The sharpest changes of mantle properties in the transition zone are across the strike of the island arc. The stressed-strained state was computed numerically using stipulated density inhomogeneities in a rectangular grid with a 50-km interval. Different types of interaction between the studied sector and the surrounding medium, which was considered elastic and with uniform density, were examined. The proposed method made it possible to evaluate the most general properties of dynamics of deep matter on the active margins of the ocean: the order of magnitude of effective viscosity and rate of movement, nature of distribution of stresses and the generalized picture of movement of mantle matter. This is illustrated in an example. Figures 3; references 25: 18 Russian, 7 Western.

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CSO: 1865/359

UDC 551.463.28

CASE OF MODULATION WAVE SCATTERING IN WAVE INTERACTION ON STATISTICALLY ROUGH SURFACE

Moscow IZVESTIYA AN SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 22, No 5, May 86 (manuscript received 5 Apr 84) pp 548-550

[Article by I.B. Yesipov, V.V. Zosimov and K.A. Naugolnykh, Acoustics Institute, USSR Academy of Sciences]

[Abstract] The article reports on characteristics of modulation waves of optical radiation during dispersion of two waves of similar frequency on the statistically free uneven surface of a liquid agitated by harmonic sound waves. Mathematical values are assigned to the surface in a free state, to the agitating sound wave, to the surface dimensions and to light wave reflections. The coincidence of sound and kinetic factors in the mathematical model and its relationship to Bragg diffraction wave modulation is attributed to surface irregularities, where the structure of the sound waves can be perceived visually. References: 3 Russian.

12131/9835
CSO: 1865/350

UDC 551.465.7

LABORATORY STUDY OF EFFECTS OF OIL FILM ON WATER EVAPORATION UNDER WINDY CONDITIONS

Moscow IZVESTIYA AN SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 22, No 5, May 86 (manuscript received 22 Oct 84) pp 553-555

[Article by V.V. Ivanov, M.P. Kolomeyev and V.M. Chekryzhov, Experimental Meteorology Institute]

[Abstract] The increasing frequency of oil spills on the world's oceans has led to the present study of wind effects on oil film and water evaporation when an oil film is present. A laboratory device with a wind channel and simulated wind is diagrammed and explained. It was used in experiments to cause variable horizontal air flow over the water channel. Results indicated that the rate of wind flow was positively related to water evaporation if the oil film was thin. If the oil film was 0.25 m or more, it significantly reduced water evaporation. Visual examination showed that with no wind the oil film was very uneven in thickness, but wind effects evened the thickness. In general much greater suppression of evaporation was observed when wind conditions were present. Figures 2; references 2: 1 Russian, 1 Western.

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UDC 551.465.55

BEHAVIORAL NATURE OF SURFACE GRAVITATIONAL WAVE SPECTRUM ON HORIZONTALLY NONUNIFORM CURRENT

Moscow IZVESTIYA AN SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 22, No 5, May 86 (manuscript received 20 Jun 84, after revision 18 Oct 84) pp 525-532

[Article by I.V. Lavrenov, Leningrad Department, State Oceanographic Institute]

[Abstract] Recently much attention has been devoted to interactions between waves and nonuniform currents, using approaches such as geometrical optics. Factors of spectral density and the evolution of wave spectra are expressed in mathematical formulas. Direct and reverse waves are defined and analyzed in relation to blocking and trajectory factors. Results indicate that in a nonuniform current the point of reflection and the point of transition from direct to reverse waves do not usually coincide. The spectral maximum is shifted to the low frequency band, while the band itself narrows. In the area of the accompanying current an opposite picture was observed as part of the wave energy was absorbed by the current and the amplitude of wave components was reduced below the limits of resistance. Wave destruction ceases and the spectral dependency drops below the balance interval. Figures 5; references 8: 4 Russian, 4 Western.

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UDC 551.465.7:551.583.7

CALCULATION OF EARTH-MOON SYSTEM TIDAL EVOLUTION BASED ON MATHEMATICAL MODEL OF TIDES IN PALEO-OCEAN

Moscow IZVESTIYA AN SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 22, No 5, May 86 (manuscript received 21 Sep 84) pp 505-512

[Article by Ye.V. Polyakov, Oceanology Institute, USSR Academy of Sciences]

[Abstract] Changes over the course of millennia are regarded to have contributed to the evolution of the Earth-Moon tidal pattern. The present reports on an attempt to calculate this evolution during the Phanerozoic using estimates of the dissipation of tidal energy based on mathematical calculations. A combination integral and differential equation are presented and discussed. A series of applied calculations involving nine variants of water and dry land, including the present distribution, and eight suggested paleoreconstructions were examined. The mathematical calculations suggested an uneven development during the Phanerozoic, involving continental movement and changes in tidal forces. The increasing distance between the Earth and the Moon was regarded as a major factor in tidal changes, along with variations in the ocean's shape and resonant qualities. Figures 2; references 14: 7 Russian, 7 Western.

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SIMULATION OF MODERN CLIMATE BASED ON OCEAN-ATMOSPHERE-ICE SYSTEM

Moscow IZVESTIYA AN SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 22, No 5, May 86 (manuscript received 5 Dec 84, after revision 10 Jun 85) pp 458-467

[Article by M.Ya. Verbitskiy and D.V. Chalikov, Oceanology Institute, USSR Academy of Sciences]

[Abstract] Study of long-range climate patterns is enhanced by models of the ocean-atmosphere-continental ice system. The article reports on improvements in the components of such a system model by mathematical revisions of earlier variants. Ocean water temperatures were divided into zones of seasonal change or constant temperature. A divergent form of heat transfer in a vertical plane was projected for all four zones of the ocean model. The Antarctic Ocean, where interaction between the other oceans takes place, was regarded to have a temperature pattern expressed by an integral heat balance. Other calculations are presented for variations in the continental ice cover, the overall system model, and interactions between the extent and thickness of ice cover and atmospheric conditions,

such as wind circulation. The model indicates that the latitude to which the ocean continues to emit heat is higher than previously suggested. Empirical data are contradictory and can only give general confirmation of the mathematical model proposed. Figures 6; references 17: 9 Russian, 8 Western.

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UDC 551.465.62:551.465.63

FREQUENCY SPECTRA OF OCEAN SURFACE TEMPERATURE ANOMALIES

Moscow IZVESTIYA AN SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 22, No 3, Mar 86 (manuscript received 18 Apr 84, after revision 20 Nov 84) pp 301-309

[Article by L.I. Piterbarg, Oceanology Institute, USSR Academy of Sciences]

[Abstract] Anomalies in ocean surface temperatures (AOST) have been studied in recent years because of their impact on climatic and synoptic processes. The article reports on statistical methods and mathematical models, taking into account the air-water contact boundary, the average thickness of the upper quasihomogeneous layer (UQL) and thermal factors. Theoretical data and 16 years of observational data collected at 59°N, 19°W were found to agree closely. Further research, aimed at developing temperature projections for various surface points, was also conducted. The results showed the manner in which various factors of spatial AOST relationships affect the spectra observed. Theoretical findings were compared with 15 years of data collected from the North Atlantic in the 35-40°N, 15-70°W region. A second mathematical model took account of random periodic fluctuations in the seasonal component of vector rates, showing how these fluctuations distort the spectra and seeking to determine if they lead to peaks on the spectral curve. Figures 3; references 12: 7 Russian, 5 Western.

12131/9835
CSO: 1865/336

UDC 551.463.21:551.466.81

RESONANCE STRUCTURE OF SPECTRAL COMPONENTS OF OCEAN ACOUSTICAL FIELD UNDER ATMOSPHERIC PRESSURE EFFECTS

Moscow IZVESTIYA AN SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 22, No 3, Mar 86 (manuscript received 24 Sep 84) pp 282-291

[Article by O.E. Gulin and V.I. Klyatskin, Pacific Ocean Oceanological Institute, USSR Academy of Sciences]

[Abstract] A version of the Riccati equation for the generation of acoustical waves is presented and discussed. Spectral components of hydrophysical fields within the medium are expressed using the squares of the transmission function and the spatial and temporal aspect of the spectral intensity density in plane waves is described. With these theoretical hypotheses in mind, a specific instance of wave spread at 1 Hz in a homogeneous ocean layer with a reflective bottom at ~6 km is used to test the theory. A stratification of sound velocity in such a medium was subjected to mathematical resolution on a computer. The effects of sound rate stratification in an underwater sound channel are described. The amplitude resonance curves in a layer of this type were found to increase, apparently due to the amplifying effect of the internal wave channel, as cycle length was shortened and the number of interacting waves was increased. A linear surface channel had more pronounced variants of these effects. Data obtained for dispersion curves in a stratified medium were readily calculated on a computer. Figures 7; references: 8 Russian.

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NEW SEISMIC REGIONALIZATION METHOD

Moscow TASS in English 23 Jun 86

[Text] Tashkent. Soviet scientists have developed fundamentally new seismic regionalization methods based on a genetic approach to earthquake forecasting.

Earth tremors are known to originate in fractures of the earth's crust. The methods developed by Soviet scientists help reveal the so-called seismogenic zones, that is areas where the natural calamity originates. The suggested method, unfortunately, cannot predict the earthquake time, but it forecasts with a great precision its place and force.

/9835
CSO: 1865/360-E

EARTHQUAKE FORECASTING BASED ON SEISMOGENIC-ZONE STUDIES

Frunze SOVETSKAYA KIRGIZIYA in Russian 21 Aug 86 p 4

[Text] Soviet scientists have developed a seismic zoning method that is new in principle. It is based on a genetic approach to forecasting earthquakes.

"This new view of the nature of earthquakes focuses on causes and regularities involved in seismic activity, rather than studying statistical data on events that have already occurred," said Doctor of Geological and Mineralogical Sciences R. Ibragimov, associate of the Uzbek Academy of Sciences' Institute of Seismology. "Earthquakes occur in faults of the earth's crust. Methods that we have developed make it possible to identify so-called seismogenic zones, that is, areas in which earthquakes originate."

During the mid-1970s, the researchers studied more than 3,000 faults of the earth's crust in eastern Uzbekistan and adjacent areas of other republics. They identified 25 faults containing latent seismic forces at deep levels. A number of seismogenic zones were identified on the basis of the data obtained. During the 1980's, eight major earthquakes, including the Pap, Isfara-Batken and Kayrakkum earthquakes, have taken place within the boundaries of these zones.

Unfortunately, the proposed methods cannot be used to predict the time when an earthquake will occur, but its location and force can be forecast with high accuracy.

In the scientists' opinion, replacement of existing maps showing traditional zones of earthquake intensity with maps showing seismogenic zones will allow better preparedness for earthquakes.

FTD/SNAP
/9835
CSO: 1865/384

WORK OF SEISMIC STATION FOR MONITORING NUCLEAR TESTS DESCRIBED

Moscow PRAVDA in Russian 26 Jul 86 p 5

[Article by A. Pokrovskiy, correspondent]

[Abstract] The article reports on the work of a seismic expedition of the USSR Academy of Sciences' Institute of Physics of the Earth and its role in monitoring underground nuclear tests. The expedition's base is in Northern Kazakhstan, on the so-called Kazakhstan platform. It is said that the granite of this platform, with a low level of microseismic oscillations and industrial disturbance, has been a favored place for testing seismic instruments for several decades. The platform also was found to be the best region of the continent for 'listening' to U.S. underground nuclear tests in Nevada. It is mentioned that American scientists recently were permitted to set up instruments on this platform, at Karkaralinsk, to take readings of a nuclear test in Nevada on 17 July.

The author of the article was shown a seismogram of this test by the head of the seismogram of this test by the head of the seismic expedition, V. Lampey, and his deputy for science, Vadim Aleksandrovich An. It is noted that An is co-author, with Ye. Lyuke and I. Pasechnik, of an article in Volume 285 of the PAPERS (DOKLADY) of the USSR Academy of Sciences for 1985. In this article, the authors analyzed seismic recordings of explosions conducted at the Nevada nuclear test site from 1961 through 1983. It is noted that they were able to discern such a fine detail as a 10-11 year period of variations of parameters of seismic waves. An said that in 20 years the expedition has built up an archives with recordings of practically all underground nuclear explosions conducted in the USA and other countries which had a force of between 1-2 kilotons and 5 megatons. This archives also contains more than 200,000 recordings of earthquakes.

It is mentioned in conclusion that the expedition has a new facility with improved instrumentation, which takes readings from holes drilled 100 meters into the granite. The capabilities of the new equipment are said to be many times greater than that of the existing facility, which has seismometers at the 15-meter level.

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RELATIONSHIP BETWEEN STRUCTURAL-MORPHOLOGICAL CHARACTERISTICS OF GOLD-BEARING QUARTZ VEIN FORMATIONS AND TECTONIC POSITION OF ORE-BEARING DIKES AND SILLS IN NORTHEASTERN USSR

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 289, No 2, Jul 86 (manuscript received 13 Jun 85) pp 439-442

[Article by A.I. Kalinin and V.M. Olshevskiy, Sevvostokgeologiya Northeastern Geological Production Association, Magadan]

[Abstract] In the Verkhoyano-Chukotka Mesozoic folded region mesothermal gold mineralization is frequently associated with bodies of igneous rocks extending primarily along the strike of plicative structures. Two groups of ore-bearing intrusive rocks can be defined which differ in tectonic position and structural-morphological type of gold-bearing bodies associated with them. Intrusions of the first type were formed prior to folding, the second--after folding. The pre-folding diabasic sills, stocks and dikes were formed in the Early Triassic. The sills are characterized by several systems of regularly oriented ore-bearing fractures (longitudinal, transverse, sub-horizontal). Longitudinal veins, for example, extend in conformity to the sills and have a dip in the opposite direction at an angle of 50-60°. The spatial relationship of these and other types of veins to stratal intrusions, regional faults and folds and to one another, as well as the morphology of the veins themselves, made it possible to visualize the kinematic course of their development, which was different for veins of different orientations. Post-folding small intrusions with gold mineralization have a considerably more extensive occurrence. These are represented by dikes, sills, laccoliths, stocks and deposits of irregular configuration, primarily of acidic and intermediate composition. The presence of gold in post-folding small intrusions is associated with quartz veins cutting igneous rocks in all possible directions and not entending into the country rock. Figures 3; references 15: 14 Russian, 1 Western.

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UDC 550.846

GOLD-BEARING SILTS OF GLACIAL LAKES AND THEIR GOLD FRACTION

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 289, No 2, Jul 86 (manuscript received 10 Jun 85) pp 494-497

[Article by T.T. Taysayev and S.I. Prokopchuk, Geology Institute, Buryat Affiliate, Siberian Department, USSR Academy of Sciences]

[Abstract] Erosion, transport and deposition of fine material by subsurface water flows is characteristic of denuded mountains on slopes with rock streams.

These processes give rise to aureoles which are formed in the course of gold mobilization on such slopes and its transport to the foot of the slope or directly into watercourses. In gold-ore zones of mountain glaciation these processes ensure active transport of gold into glacial lakes. A study was made of secondary gold aureoles in a series of glacial lakes. During frost weathering gold is easily freed from oxidized ores and is actively entrained into mechanical migration. Glacial lakes constitute favorable traps for gold concentration. The fine transported gold is completely precipitated and accumulated in lakes prior to their complete silting. The gold concentration in bottom sediments of 10 samples lakes varied from 0.003 to 0.1 g/ton and is dependent on the degree of mineralization, geomorphological conditions and location of the ore zones on the slopes of cirques and troughs. The distribution of gold fractions was determined by a method developed at the Geochemistry Institute. The granulometric composition could be determined in the range 3-25 μm, in five gradations: 3-5, 5-9, 9-12, 12-15 and 15-25 μm. At the present time glacial lakes are being sought out in gold-bearing areas of denuded regions which are being silted up by gold-bearing sediments or have been completely filled with them. Significant quantities of gold can accumulate in such lakes under favorable landscape and geochemical conditions in areas with rich bedrock sources of gold. Improved methods and equipment may make their commercial exploitation feasible. Figures 1; references 7: 6 Russian, 1 Western.

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UDC 550.83.015.072

IDENTIFYING CRITERIA FOR PROSPECTING FOR REEF FORMATIONS BY COMBINED MODELING OF WAVE AND ELECTROMAGNETIC FIELDS

Moscow GEOLOGIYA NEFTI I GAZA in Russian No 6, Jun 86 pp 13-16

[Article by N.P. Ugarova, O.A. Ageyeva and V.V. Tikshayev, Nebit Dag Scientific Research Institute for Geology and Geophysics]

[Abstract] Difficulties have been experienced in the interpretation of data obtained by electric and seismic prospecting in complexly structured regions of the Caspian depression with well-developed salt dome tectonics. This is attributable to the presence of various horizontal inhomogeneities in the section. These exert a considerable influence on artificial generation of an electromagnetic field and on the propagation of seismic oscillations. The best approach for overcoming these difficulties is a combining of these data and construction of seismoelectric time sections. This requires a knowledge of the ways in which different types of inhomogeneities are manifested in the wave and electromagnetic fields and the behavior of the coefficient relating the times of signal registry in seismic and electric propsecting. A method is proposed for combined modeling of wave and electromagnetic fields over horizontally inhomogeneous media of this type. The

physicomathematical modeling described combines physical modeling for electric prospecting and mathematical modeling for seismic prospecting. The possibilities of such modeling were investigated using a simple geological-geophysical model. Specific information is given on these modeling procedures. Examples of application of the model reveal that the main criteria for detecting reef formations can be determined by constructing synthetic seismoelectric time sections for specific models of reef traps. For example, for the formations characteristic of the northern marginal zone of the Caspian depression such criteria are a reduction in thickness and decrease in longitudinal conductivity of the rock layers overlying the reef. Figures 3; references: 4 Russian.

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UDC 551.7:552.5(26)

NEW PRINCIPLES FOR STRATIFICATION OF SEDIMENTARY FLOOR OF SEA AREAS

Novosibirsk TIKHOOKEANSKAYA GEOLOGIYA in Russian No 3, May-Jun 86
(manuscript received 13 Feb 85) pp 31-36

[Article by V.O. Savitskiy and I.I. Khvedchuk, Dalmorneftegazgeofizrazvedka Trust (Far Eastern Marine Petroleum and Gas Geophysical Prospecting Trust)]

[Abstract] Advances in seismic prospecting, together with progress in sedimentology and facies analysis, has made possible the interpretation of seismic materials on a qualitatively new level. A new field in geology, seismic stratigraphy, affords real possibilities for defining new principles for stratification of layered sedimentary strata in sea areas. In most sedimentation basins the new procedures of seismostratigraphy make it possible to identify the natural stages in their development by use of a newly defined seismostratigraphic unit, the depositional sequence. This taxon, representing a natural geological body or geostratigraphic subdivision, is the main unit for carrying out stratigraphic and general geological analysis of seismic materials. The new seismic stratigraphy is of fundamental importance in revealing the geological structure of sedimentary basins of the past. Structural-stratigraphic subdivisions can be discriminated, stratigraphic correlation can be carried out, new independent stratigraphic diagrams can be compiled, the nature of the boundaries of the discriminated subdivisions can be determined, the behavior of these boundaries can be ascertained, the scales of the principal nonconformities and gaps can be evaluated and the pattern of changes in thickness can be plotted. Application of the principles of seismofacies analysis makes it possible to draw important paleogeographic and paleotectonic conclusions and solve problems which were earlier beyond the scope of acoustic stratigraphy. The application of the fundamental ideas and principles of seismostratigraphic analysis involves a number of methodological difficulties, among which one of the most important is the lack of a unified terminology. It is recommended, for example, that

the term "depositional sequence" be replaced by "sedimentary complex." Figures 1; references: 3 Russian.

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UDC 550.834.5.05:551.7.022(571.642)

SEISMOSTRATIGRAPHIC BREAKDOWN OF SECTION OF NEOGENE DEPOSITS IN SOUTHEASTERN REGION OF NORTHERN SAKHALIN

Novosibirsk TIKHOOKEANSKAYA GEOLOGIYA in Russian No 3, May-Jun 86 (manuscript received 11 Sep 85) pp 37-44

[Article by Yu.V. Lopatnev and I.K. Tuyezov, Tectonics and Geophysics Institute, Far Eastern Scientific Center, USSR Academy of Sciences, Khabarovsk; Sakhalinmorneftegazprom (Sakhalin Marine Petroleum and Gas Industry) All-Union Production Association, Oka-na-Sakhaline]

[Abstract] The interpretation of common depth point data for the southeastern part of northern Sakhalin has yielded much new information on the stratigraphic breakdown and facies makeup of Negoene deposits in that region. This has greatly supplemented data obtained by exploratory drilling. A relationship was found between the seismostratigraphic subdivisions of the section and the suites and stratigraphic horizons occurring in this region. A seismofacies analysis was used in revealing changes in the lithological-facies makeup of the deposits and more precise definition of the boundaries of stratigraphic horizons. All this made it possible to predict the distribution of lithological traps of various types of hydrocarbons in depth and over the area. The search for nonanticlinal traps in this particular sedimentary basin is becoming one of the main directions in petroleum- and gas-prospecting work. This requires seismic investigations at the highest technical level with subsequent interpretation of the results on an accurate seismostratigraphic base. A number of recommendations are given on future exploratory work. Figures 6; references 13: 12 Russian, 1 Western.

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HORIZONTAL MOVEMENTS OF EARTH'S SURFACE IN NEIGHBORHOOD OF CENTRAL SAKHALIN DEEP FAULT

Novosibirsk TIKHOOKEANSKAYA GEOLOGIYA in Russian No 3, May-Jun 86
(manuscript received 2 Apr 84) pp 45-49

[Article by N.F. Vasilenko and Ye.D. Bogdanova, Institute of Marine Geology and Geophysics, Far Eastern Scientific Center, USSR Academy of Sciences, Novoaleksandrovsk]

[Abstract] During the last 10 years repeated geodetic measurements have been made in three geodynamic test ranges on Sakhalin in the neighborhood of the Central Sakhalin deep fault, the largest fault on the island, in order to determine the nature of recent horizontal crustal movements. The registered geodetic measurements were made using the theory of deformations and the finite elements method. The nature of deformation of the Central Sakhalin fault zone was determined during periods of anomalous horizontal movements. The predominant direction of the axes of the main deformations was determined. The maximum dilatation axis has a submeridional orientation, whereas the compression axis has a sublatitudinal orientation, across the strike of the main morphostructures on the island. During 1975-1978 there was a right-handed shear along the fault, by 1979 replaced by well-expressed sublatitudinal compression of the fault zone. Active dilatation was observed in the fault zone during 1979-1980. During the period 1980-1983 there was a lessening of deformations and their intensity dropped off by almost an order of magnitude in comparison with the period 1977-1979-1980. Annual geodetic observations will make it possible to clarify the mechanism of accumulation and release of deformations, their cyclicity and relationship to seismic events. Figures 4; references: 12 Russian.

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UDC 552.2

LOW-TEMPERATURE CHANGES OF MAGMATIC ROCKS ON SEA OF JAPAN FLOOR

Novosibirsk TIKHOOKEANSKAYA GEOLOGIYA in Russian No 3, May-Jun 86
(manuscript received 7 May 84) pp 58-63

[Article by A.V. Mozherovskiy, Pacific Ocean Oceanological Institute, Far Eastern Scientific Center, USSR Academy of Sciences, Vladivostok]

[Abstract] A collection of magmatic rocks was obtained during geological work in the Sea of Japan. Although an extensive literature exists on these rocks, no attention has been given to their secondary modifications. An analysis was made of about 150 samples from 57 stations to determine their secondary changes. The mineralogical analysis for each sample is tabulated.

The principal process of secondary mineral formation on the sea floor was the smectization of magmatic rocks. This process affected all effusive rocks. Two types of changes of basalts were found, characterized by different conditions of mineral formation. The first type is characterized by Fe-dioctahedral smectites, mixed-layer formations of the hydromica-smectite series, zeolites and iron hydroxides forming under oxidative conditions. The second type is characterized by Fe-Mg trioctahedral smectites, hydromicas, calcite (systems with impeded water exchange). The predominant formation of dioctahedral smectites is attributable to oxidative conditions of mineral formation. The formation of dioctahedral smectites may be related to an andesitic type of volcanism characteristic of marginal seas. Several stages of secondary mineral formation can be defined, taking into account the range of secondary minerals and their petrographic characteristics. The secondary minerals may have been formed at high temperatures. Dioctahedral smectities, zeolites and calcite could be formed during halmyrolysis or during secondary heating. Trioctahedral smectites indicate a change from oxidative conditions to conditions with impeded water exchange. Mineral formation in magmatic rocks on the Sea of Japan floor is therefore a result of low-temperature interaction between rock and sea water. Figures 3; references 10: 5 Russian, 5 Western.

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UDC 552.31:550.42:551.242.21

NEW DATA ON STRUCTURE OF KURILE-KAMCHATKA TRENCH

Novosibirsk TIKHOOKEANSKAYA GEOLOGIYA in Russian No 3, May-Jun 86 (manuscript received 24 Jun 85) pp 64-73

[Article by B.I. Vasilyev, I.A. Tararin, I.N. Govorov and Yu.I. Konovalov, Pacific Ocean Oceanological Institute, Far Eastern Scientific Research Center, USSR Academy of Sciences; Far Eastern Geology Institute, Far Eastern Scientific Center, USSR Academy of Sciences, Vladivostok]

[Abstract] Dredgings were carried out in the Kurile-Kamchatka abyssal trench by specialists of the Pacific Ocean Oceanological Institute aboard the research ship "Akademik Aleksandr Nesmeyanov" in July-August 1984. The most detailed work was done in its central part and a bathymetric chart was compiled at 1:250,000. A total of 23 dredgings were made (12 on the island side, 11 on the oceanic side). New data were obtained on the geological structure of the trench and its geological section was constructed for the first time. The discovery of garnet-containing metamorphic apoterrigenous rocks in association with pyroxenites at the base of the trench section suggests that they form the basement of the arc-trench structure and amidst a thick stratum of pillow lavas there are tholeiitic basalts of the oceanic type in the form of tectonic blocks uplifted along faults. The covering complex of tholeiitic basaltoids and other associated rocks make up the oceanic slope of the trench. Locally on the stratum of tholeiitic basaltoids there are lavas with pyroclastic formations of intermediate and acidic

composition, subjected to greenstone modification, together with individual volcanoes of the central type which pour out melts of subalkaline basalts and trachybasalts. Beginning with the Late Pliocene-Pleistocene the present-day structure of the trench was formed and its filling with nondislocated sediments has been occurring. The research made it possible to define seven stages in the geological development of the Kurile-Kamchatka trench. Figures 3; references 10: 9 Russian, 1 Western.

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UDC 550.831:551.24

GRAVITY ANOMALIES AND THEIR RELATIONSHIP TO CRUSTAL AND UPPER MANTLE STRUCTURE IN MIDDLE KURILES REGION

Novosibirsk TIKHOOKEANSKAYA GEOLOGIYA in Russian No 3, May-Jun 86 (manuscript received 8 May 85) pp 74-79

[Article by V.Yu. Kosygin, V.N. Senachin, L.M. Lyutaya and O.N. Romashova, Institute of Marine Geology and Geophysics, Far Eastern Scientific Center, USSR Academy of Sciences, Novoaleksandrovsk]

[Abstract] Marine gravimetric research carried out over a period of years by the Institute of Marine Geology and Geophysics made it possible to construct more detailed maps of the anomalous gravity field in the Middle Kuriles region in the Faye, Bouguer and isostatic reductions (Figures 1, 2, 3 in text). These data were used in studying the relationship between gravity anomalies and structure of the crust and mantle in this region. Conclusions are drawn on the relationship between the isostatic state of the crust and crustal and mantle processes transpiring in relatively recent geological time and in the modern stage. A decrease in seismic activity and an increase in volcanic activity and heat flow in this region, despite a relative decrease in the intensity of all crustal isostatic characteristics, indicate the closest approach of the heated anomalous mantle to the surface. For these reasons the isostatic adjustment of lithosphere blocks occurs considerably more rapidly than on the flanks of the Kurile arc. Ascending flows of light heated mantle matter are uplifting the lithosphere more intensively than it is plunging as a result of isostatic forces due to eclogitization of the basalt layer. The surface manifestation of increased volcanism and heat flow and reduced seismicity is attributable to the closeness of the hot anomalous mantle to the surface. Figures 5; references 7: 6 Russian, 1 Western.

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VOLCANIC-TECTONIC MODEL OF OCEAN FORMATION

Moscow VULKANOLOGIYA I SEYSMOLOGIYA in Russian No 3, May-Jun 86
(manuscript received 12 Dec 84) pp 3-11

[Article by A.Ye. Svyatlovskiy, All-Union Scientific Research Institute of Foreign Geology]

[Abstract] Based on a report presented at the International Geological Congress in Moscow in 1984, this article suggests a somewhat new theory on the means by which the oceans came into existence. It is postulated that major inhomogeneities in the structure of the oceanic crust attest to its structural formation under the influence of vertical and horizontal tectonic movements in association with volcanism and sedimentation. An attempt can be made to reconcile or integrate the theoretical premises of structural analysis of the ocean floor--continental drift and the earth's expansion. It is proposed that "telescoped" riftogenesis, volcanic-tectonic processes in volcanic zones, in application to the oceans, solves the fundamental problems involved in interpreting their structure without need for recourse to other hypotheses. On such a basis it then becomes possible to explain the symmetric increase in the age of basalts in the second layer of the ocean floor in the direction of the continents, the sequential change in the vertical section of bottom deposits upward from the second-layer basalts to shallow-water limestones and abyssal clays and the decrease in the extent of Mesozoic and Cenozoic continental transgressions and regressions as a result of an increase in the volume of oceanic basins with a narrowing of volcanic-tectonic zones of uplifts and rifting toward the centers of the oceans, accompanied by a corresponding decrease in the areas of basalt outpourings. Figures 5; references 13: 5 Russian, 8 Western.

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UDC 551.21

INERTIAL MODEL OF FOCUS AND POSSIBILITIES OF PREDICTING REPEATED EARTHQUAKE

Moscow VULKANOLOGIYA I SEYSMOLOGIYA in Russian No 3, May-Jun 86
(manuscript received 11 Mar 85) pp 49-57

[Article by A.V. Vvedenskaya, Earth Physics Institute, USSR Academy of Sciences]

[Abstract] After reviewing the fundamental principles of the theory of destruction of solids, an attempt is made to ascertain the nature of rock destruction at an earthquake focus on the basis of seismograms interpreted on the basis of a specially formulated inertial model of an earthquake focus. This made it possible to determine the quantitative parameters

distinguishing primarily viscous and primarily brittle destruction, which in turn can be used as a prognostic criterion for predicting appearance or nonappearance of a very strong repeated earthquake. Primarily viscous destruction occurs in areas coinciding with the focal plane, whereas primarily brittle destruction occurs on surfaces cutting the focal plane. This phenomenon, known as the "Kurile effect," accounts for the series of very strong earthquakes arising in this particular region due to the high rate of deformation. A repeated earthquake can be predicted under such conditions. Unlike this case of brittle destruction, viscous destruction was operative in the area of the Gazli earthquakes, for which the seismograms revealed no clue of an impending repeated earthquake. A great time lapse between events (in this case 40 days) exceeds the possibilities of predicting a repeated earthquake by seismodynamic methods due to the relatively slow and stable rate of deformation, contrasting with the rapidly transpiring deformation characteristic of Kurile events. Figures 4; references 5: 3 Russian, 2 Western.

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CONCENTRATION OF SEISMOGENIC FAULTS PARAMETER AS PRECURSOR OF STRONG EARTHQUAKES ON KAMCHATKA

Moscow VULKANOLOGIYA I SEYSMOLOGIYA in Russian No 3, May-Jun 86 (manuscript received 14 Sep 84) pp 58-71

[Article by A.D. Zavyalov, Earth Physics Institute, USSR Academy of Sciences]

[Abstract] The concentration of seismogenic faults parameter K_{sf} is the ratio of the mean distance between seismogenic faults which occurred in some seismically active volume V_i during the time ΔT_i to their mean length. A study was made of problems related to the use of this parameter in predicting earthquakes and the characteristics of behavior of spatial distributions of K_{sf} prior to the strongest seismic events of 1971-1973. The results of a retrospective prediction of Kamchatkan earthquakes of the energy classes $K^{F68}_{S1\ 2} \geq 13.5$ for the years 1962-1982 was made and this was used in formulating a scheme for use of the K_{sf} parameter in practical predictions. It was established that zones of reduced K_{sf} are formed several years prior to a future earthquake in the region of its hypocenter. An evaluation of the statistical significance of the retrospective prediction revealed its high efficiency in comparison with random guessing. The first successful use of the K_{sf} parameter for a retrospective prediction confirms the validity of the concept of a critical density of faults. Examples of the behavior of the spatial distributions of K_{cf} show that the algorithm prepared for computing K_{sf} properly takes into account changes in the seismic regime transpiring during the course of preparation of strong earthquakes and after them. Figures 5; references 15: 14 Russian, 1 Western.

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UDC 550.341.5

VARIANT OF LONG-RANGE SEISMIC PREDICTION FOR KAMCHATKA BAY AND KRONOTSKIY PENINSULA

Moscow VULKANOLOGIYA I SEYSMOLOGIYA in Russian No 3, May-Jun 86
(manuscript received 13 Jan 84) pp 72-83

[Article by A.V. Vikulin, Complex Earthquake Physics Expedition, Earth Physics Institute, USSR Academy of Sciences]

[Abstract] A number of published sources give the possible position of the foci of future very strong earthquakes in the seismically active volume of Kamchatka in the neighborhood of the Kronotskiy Peninsula and the adjacent Kronotskiy and Kamchatskiy Bays. These long-range seismic predictions are based on determinations of the foci of five earthquakes with $M \geq 7 3/4$ which occurred in 1915, 1917, 1923, 1959 and 1971. The development of new methods and concepts and the availability of new data made the need for redetermining the epicenters of these key events quite essential. Particular attention was given to the events of 1915, 1917 and 1923. The position and extent of these earthquake foci were redetermined. The location of the foci of future Kurile-Kamchatka earthquakes is most probable in places where events of great intensity have not occurred in the course of the seismic cycle. A redetermination of the location and extent of the foci in the neighborhood of the Kronotskiy Peninsula and the bays adjacent to it necessitated a change in the long-range seismic prediction for this region. The long-range seismic prediction was therefore formulated as follows. The most probable places of occurrence of foci of future earthquakes with $M \geq 7.6$ are the areas opposite the Kronotskiy Peninsula and the northeastern part of Kronotskiy Bay. Earthquakes with $M \geq 7.6$ probably cannot occur during the coming decades within the limits of Kamchatskiy Bay since the seismically active volume of this part of the region was occupied by the foci of earthquakes in 1923 and 1971. A figure shows the position of predicted future foci. The new prediction variant differs from all predictions published earlier.
Figures 6; references 39: 33 Russian, 6 Western.

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CSO: 1865/359

UDC 551.577.21

ATMOSPHERIC FRONT PRECIPITATION INTENSITY SPECTRA

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 22, No 7, Jul 86 (manuscript received 5 Jul 83; after revision 25 May 85) pp 712-719

[Article by A.A. Lyakhov and N.P. Shakina, USSR Hydrometeorological Center]

[Abstract] Precipitation intensity spectra were computed for zones of atmospheric fronts during the warm season of the year. The study was based on measurements of temporal and spatial changes in precipitation intensity as registered in a special pluviographic test range of the State Hydrological Institute at Valday (40 rain gage stations located in an area measuring 25 x 25 km). The analyzed data were obtained during the passage of two warm fronts and three cold fronts. The precipitation field usually consisted of one or two main zones of increased rainfall intensity. One is associated directly with the frontal line, whereas the other is parallel to it and displaced relative to the front in the direction of the cold air. The width of this second zone, the intensity of convective processes and precipitation in it can be greater than for the first. In the course of frontal evolution there are transitions from one- to two-zone structure and back. With high resolution of data it is possible to detect smaller-scale structural details, such as secondary, weaker bands superposed on the system of main zones. The literature contains virtually no information on precipitation intensity spectra for middle-latitude cyclones, although such information is highly important for understanding the structure of the precipitation field and vertical movements. In the studied cases at high frequencies (periods up to 30-40 minutes) there were power-law parts of spectra with slopes close to -5/3 or to -2 in a great part of the range. In the source region (at periods greater than 30-40 minutes) there were peaks which were coherent for closely spaced stations or even at the scale of the entire test range and which reflect the quasiregular structure of precipitation, that is, the presence of convection zones. Figures 4; references 19: 12 Russian, 7 Western.

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CSO: 1865/391

UDC 551.554

ATMOSPHERIC WIND SOUNDING USING CONTINUOUS DOPPLER SYSTEMS

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 22, No 7, Jul 86 (manuscript received 11 Jan 84, after revision 14 Nov 85) pp 720-727

[Article by A.G. Gorelik and V.V. Sterlyadkin]

[Abstract] The principal shortcoming of presently available methods for determining the vertical wind profile in the lower layers of the atmosphere is the difficulty of their use under extremal conditions, such as during the falling of heavy precipitation, when strong winds are blowing, during hurricanes or in thick fogs. The possibility of determining the vertical wind profile from the form of the spectrum of a reflected signal when using Doppler stations with continuous unmodulated radiation was pointed out for the first time by the authors in METEOROLOGIYA I GIDROLOGIYA, No 4, pp 46-52, 1984. Such a continuous Doppler system is unrestricted with respect to the range of measured wind velocities and therefore the development of all-weather wind sounding measurements on their basis is entirely feasible. A changeover to the submillimeter and optical wavelength ranges is very desirable. Aerosols and other wind-entrained inhomogeneities can serve as scatterers. The joint operation of continuous Doppler systems in the optical and microwave ranges would make it possible to carry out wind measurements regardless of weather. Formulas are derived for solving the inverse problem of retrieving the wind profile in the boundary layer from spectra obtained with continuous Doppler systems. This is illustrated by actual measurements made with a single-wavelength Doppler radar operating at 3.2 cm, system potential 160 db, radiation power about 5 W, directional diagram width 3°. In the example of a two-wavelength system, it is shown that its principal advantage is a considerable decrease in errors associated with nonuniform spatial distribution of scatterers. The advantages of operating in the optical range are discussed. Such systems are difficult to use when precipitation is falling, but in such cases the microwave range could be used. However, the joint operation of microwave and optical systems would yield the greatest information and meteorological conditions would no longer be a factor. Figures 2; references 13: 9 Russian, 4 Western.

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UDC 551.563.5:551.521.31

LIGHT PROPAGATION IN STRATIFIED MEDIUM WITH HIGHLY ANISOTROPIC SCATTERING

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 22, No 7, Jul 86 (manuscript received 2 Jan 85) pp 736-742

[Article by V.S. Remizovich, D.B. Rogozkin and M.I. Ryazanov, Moscow Physical Engineering Institute]

[Abstract] When describing light transmission through scattering media it is often necessary to take into account the change in optical properties of the medium along the direction of beam propagation. In the propagation of light in a stratified medium with strong absorption the joint effect of absorption and scattering becomes important at depths where the angular spectrum is still sharply anisotropic. In an earlier study (IZV. AN SSSR: FAO, Vol 19, No 10, pp 1053-1061, 1983) the authors used a small-angle diffusional approximation with allowance for the scatter of photons along the traversed paths for describing light propagation in thick layers of a stratified turbid medium with highly anisotropic scattering. It was found that in such an approximation the problem of description of light propagation in a stratified medium can be reduced to solution of one second-order ordinary differential equation for the coefficient determining the influence of elastic scattering on attenuation of the radiation flux. Proceeding on the basis of this earlier work, an exponential model of a stratified turbulent medium is used in a detailed analysis of the influence of a nonuniform distribution of optical properties on light propagation in an absorbing medium with highly anisotropic scattering. It is shown that the anisotropy of angular distribution of radiation is expressed most sharply when absorption predominates at great depths. Figures 2; references 8: 7 Russian, 1 Western.

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UDC 551.551

VARIABILITY OF TEMPERATURE FLUCTUATION SPECTRA IN ATMOSPHERIC BOUNDARY LAYER

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 22, No 7, Jul 86 (manuscript received 25 Jan 85) pp 675-681

[Article by V.A. Bezverkhniy, A.S. Gurvich and V.P. Kukharets, Atmospheric Physics Institute, USSR Academy of Sciences]

[Abstract] A study was made of the variability of spectra of turbulent temperature fluctuations θ in the atmospheric boundary layer. The spectra were computed using a relatively large number of relatively short segments of a quite long $\theta(t)$ record obtained on magnetic tape during aircraft flight.

Flights were at an altitude of 750 or 250 m along a straight line at a speed 64 m/s. The Θ measurements were made with a resistance thermometer (sensor time constant not greater than 1 ms, thermometer transmission band limited upward by a filter with a cutoff frequency 40Hz; interval between readings on magnetic tape 15.625 ms; spatial interval 1.0 m; length of record 64,512 readings at 750 m, 61,440 at 250 m; each record about 16 minutes in duration, during which the aircraft flew about 63 km over the even steppe in the neighborhood of Tsimlyansk). Intermittence was investigated using the spectral-time analysis method modified applicable to study of random processes with power-law spectra. The statistics of periodograms obtained along short flight path segments was analyzed, making it possible to obtain the first quantitative estimates of the intermittence of turbulence in the boundary layer. In the inertial interval of frequencies each of the periodograms can be approximated by a power law Af^b, where f is frequency, A and b are random parameters. The mean value of the exponent b is close to -5/3. The observed scatter of b values is statistically significant and increases with a decrease in the length of the segment. The distribution of probabilities of periodogram values differs greatly from the χ^2 law with the degree of the difference being governed by the ratio of the internal scale to the length of the segment. Figures 2; references: 13 Russian,

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UDC 528.061.2

IMPROVED METHOD FOR DETERMINING VERTICAL REFRACTION

Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 7, Jul 86 pp 18-20

[Article by V.V. Vinogradov]

[Abstract] A new method is proposed for determining vertical refraction on the basis of measurements of fluctuations of the angles of incidence of a light wave by a highly precise theodolite. The method is compared with the similar method described by V.Ye. Dementyev in KVANTOVAYA ELEKTRONIKA, Vol 9, No 4, pp 789-790, 1982, and a method based on determining the angular diameter of image blurring of a radial mire described by V.V. Vinogradov, IZV. VUZov: GEODEZIYA I AEROFOTOSYEMKA, No 2, pp 32-39, 1985. The distinguishing feature of the proposed method is that it is possible to determine the angle of vertical refraction directly from the zenith distances measured with a theodolite, that is, from the integral parameters of the refraction trajectory, which correctly reflects the state of the atmospheric surface layer. There is no need for organizing special bases with known relative elevations between the ends of the trajectory in order to compute the angles of refraction. This method has an accuracy (within the limits of $\pm$5-10%) comparable to the methods proposed earlier. The method was tested in the field in 1983 along a path measuring about 1,150 m and careful checking revealed that the method under many conditions is both more

convenient, but also comparable (within accepted tolerances) in accuracy to methods employed earlier. Figures 2; references 7: 6 Russian, 1 Western.

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UDC 551.521.31

SPECTRAL LIGHT SCATTERING COEFFICIENTS FOR ATMOSPHERIC SURFACE LAYER

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 22, No 6, Jun 86 (manuscript received 13 Dec 84; after revision 25 Mar 85) pp 588-594

[Article by M.A. Derbisalin, G.Sh. Livshits and O.D. Tokarev, Kazakh Pedagogic Institute]

[Abstract] Measurements in the wavelength range 0.4-0.9 λm were made in the atm spheric surface layer for determining spectral light scattering coefficients under different meteorological conditions. The measurements, extending over a period of a decade, were for ascertaining background values and coefficient values in the Alma-Ata area, an industrial region. Optical and meteorological measurements were made at the same time. Statistical data were collected which made it possible to compare the properties of haze in different places and during different seasons, to clarify the role of meteorological conditions and to seek any informative data on the optical characteristics of aerosol. The scattering coefficient was determined by the nephelometric method, using the scattering indicatrix. A study was made of drift of the nephelometric scattering index as a function of observation conditions and the wavelength of light. This revealed that there are several distinctive types of spectral dependence of the aerosol scattering coefficient corresponding to definite types of atmospheric haze. The relationship between the scattering coefficients, meteorological parameters and the dry fraction of aerosol was analyzed. The presently used nephelometric method for determining the range of visibility by measuring the intensity of scattered light at a definite angle requires correction. Laboratory measurements are of limited value in interpreting measurements under natural conditions. Figures 4; references 10: 9 Russian, 1 Western.

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UDC 551.521.31

USE OF SPHERICAL HARMONICS IN DETERMINING RADIATION TRANSFER IN BROKEN CLOUDS

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 22, No 6, Jun 86 (manuscript received 17 Dec 84, after revision 25 Mar 85) pp 600-606

[Article by T.B. Zhuravleva and G.A. Titov, Atmospheric Optics Institute, Siberian Department, USSR Academy of Sciences]

[Abstract] In order to study the probabilistic properties of real cloud cover and radiation fields it is proposed that use be made of equations relating the statistical characteristics of the cloud cover and light field. In the past such equations, applicable to a broken cloud cover, have been solved in a transport approximation and by the Monte Carlo method. The Monte Carlo method, although more effective than others, requires a great expenditure of computer time. An approximate method was therefore sought for solution of such equations which would be practical in use, not time consuming and which could be solved by comparison with standard computations. The article gives the derivation of a system of equations for the mean intensity of short-wave optical radiation which can be solved by the spherical harmonics method. This is illustrated by a so-called P_1 approximation which is given for conservative scattering which occurs in the visible spectral region for clouds consisting of water droplets or ice crystals. In solving this problem by the Monte Carlo method algorithms for five values of the probability of presence of clouds tens of minutes of computer time were requires and the accuracy was about 5%. With the P_1 approximation the required time was several seconds and the accuracy in most cases was about 15-20%. Figures 1; references: 11 Russian.

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CSO: 1865/373

GIANT AEROSOL CLOUDS STUDIED WITH AIRBORNE LASER COMPLEX

Moscow IZVESTIYA in Russian 8 Aug 86 p 3

[Article by L. Levitskiy, correspondent (Tomsk)]

[Abstract] The article reports on studies of atmospheric phenomena called "mesoscale aerosol clouds". Airborne equipment is being used in this research, which is in its fourth year at the Institute of Atmospheric Optics of the Academy of Sciences' Siberian Branch. Scientists oftthis institute are credited with discovering the existence of the aerosol clouds and developing methods for detecting them. Studies of such clouds were being made by junior science associate B. Belan and other researchers under the direction of G. Zadde, head of a laboratory.

Mesoscale aerosol clouds are said to be invisible to the human eye. Academician Vladimir Yevseyevich Zuyev, director of the institute, explained that they consist of aerosol particles which are so small that they produce practically no effect on scattering of light. They are found with the aid of superprecise instruments which detect differences between the passage of a laser beam through a cluster of aerosol particles and through clear air. The clouds which are largely of natural origin, form in clear weather at altitudes of 1,200-3,500 meters through the action of anticyclones. They may grow to lengths as great as 40 kilometers and become as thick as 1 kilometer. Zuyev believes that aerosol clusters become nuclei around which ordinary clouds form through condensation of water vapor. Observations of such clusters' movements thus may lead to more accurate weather forecasting.

An account is given of two flights which the author of the article made from Novosibirsk to Chardzhou, on board an IL-14 laboratory airplane. In the course of these flights, observations of aerosol clouds were made from the airplane with the aid of a unique laser complex which scientists of the institute developed for probing the atmosphere. This complex is said to include a photoelectric counter and electronic equipment for receiving and interpreting target signals.

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UDC 551.521.3

POSSIBILITY OF DETERMINING EFFECTIVE PHOTON PATH LENGTH IN CLOUDS IN IR SPECTRAL REGION USING CO_2 ABSORPTION BAND 2.06 μm

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 22, No 6, Jun 86 (manuscript received 5 Dec 84) pp 607-615

[Article by Ye.I. Grechko, S.V. Dvoryashin and V.I. Dianov-Klokov, Atmospheric Physics Institute, USSR Academy of Sciences]

[Abstract] In studying the energetics of the cloudy atmosphere valuable information can be obtained by investigating the extinction of solar and terrestrial radiation in the absorption bands of atmospheric gases. Data on the path lengths of photons forming fluxes relfected and transmitted by clouds can be used, especially the effective path length ℓ_{eff}, the path length of photons in a nonscattering absorbing atmosphere, along which the extinction of radiation is equivalent to the attenuation of radiation due to absorption in a scattering and absorbing atmosphere. Such a study was made using the absorption band of carbon dioxide (λ = 2.06 μm). The optical density of this band was studied at the absorption maxima of the R- and P-branches as a function of variations of the temperature profile and moisture content in an atmospheric column. The atmosphere was broken down

into 16 layers with constant pressure, temperature, CO_2 and water vapor contents in making the needed computations in conjunction with summer and winter model temperature profiles. The influence of absorption of the droplet water of clouds on ℓ_{eff} was studied and it was found that ℓ_{eff} measured in the CO_2 absorption band is close to the path determined by absorption by cloud droplet water. Figures 4; references 18: 14 Russian, 4 Western.

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UDC 551.521.3:551.510.53

VARIATIONS IN OPTICAL PROPERTIES OF STRATOSPHERIC AEROSOL

Moscow IZVESTIYA AN SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 22, No 5, May 86 (manuscript received 11 Nov 84, after revision 19 Jul 85) pp 497-504

[Article by M.S. Kiseleva]

[Abstract] The urgency of studies of optical properties in stratospheric aerosol levels relates to radiation processes. The article reports on analysis of spectra of stratospheric aerosol to be used in formulating mathematical models of stratospheric changes. Measurements were made in Central European parts of the USSR and in Central Asia. Effective parameters of aerosol fractions in Aitken nuclei at ~20 km in altitude were found to be close to expected submicron or sulfate particles. The results show the effect effectiveness of the mathematical model approach for projecting changes in stratospheric aerosol levels. The areas with high concentrations of Aitken nuclei that poorly disperse radiation in the visible spectrum and which are highly absorbent in the infrared spectrum were typical for both states of the stratosphere, which differed in their content of submicron particles, sharply in the visible range and less so in the infrared spectral range. Figures 5; references 32: 16 Russian, 16 Western.

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UDC 551.521.3:551.510.42

HIGHLY DISPERSE AND SUBMICROSCOPIC ARID ZONE AEROSOL

Moscow IZVESTIYA AN SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 22, No 5, May 86 (manuscript received 2 Aug 84) pp 488-496

[Article by Yu.V. Zhulanov, V.A. Zagaynov, A.A. Lushnikov, Yu.S. Lyubovtseva, I.A. Nevskiy and L.D. Stulov, Scientific Research Physico-Chemical Institute imeni L.Ya. Karpov]

[Abstract] Clear understanding of the role of atmospheric aerosols in forming the earth's climate requires study of their role in the atmosphere's radiation balance and clarification of mechanisms of their production and factors influencing the fate of aerosol particles in the atmosphere. Current concepts address factors such as dispersion (primary) and condensation (secondary) aerosol mechanisms, with terrestial and atmospheric or solar sources respectively. The article presents the results of observations of changes in concentrations over 24 hours and average dispersion values; data were collected in Tajikistan during September 1981. Along with determination of dimensions and concentrations, visual observations and microscopic and spectroscopic analyses were made. Results showed little daily variation in concentration, and the most marked absorption bands in the arid zone were related to mineral components, including carbonates, nitrates and sulfates. Analysis by particle size showed that coneentration factors were not the only sources of new aerosol particles; sedimentation and other condensation processes, along with coagulation, affected the growth in particle size. Precipitation was a fundamental factor in developing highly dispersed aerosol particles in the atmosphere. Figures 5; references 9: 5 Russian, 4 Western.

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CSO: 1865/350

ICEBREAKER 'SHMIDT' BACK FROM RESEARCH CRUISE IN ARCTIC

Moscow PRAVDA in Russian 25 Aug 86 p 1

[Article by A. Minayev, correspondent]

[Text] Murmansk, August 24--The icebreaker 'Otto Shmidt', which was built to orders of the Arctic and Antarctic Scientific Research Institute, has successfully completed its 25th cruise.

Valuable scientific information in the fields of oceanography and meteorology has been amassed in the time that this vessel has been in service. Studies have been carried out in the Barents Sea, in the southern part of the Arctic Ocean, and also in the Greenland, Kara, White and Norwegian Seas. The crew of the icebreaker, which has 14 scientific laboratories on board it, has traveled nearly 200,000 miles of difficult crossings, studying the ecological system of the Arctic basin. The information about it is very important for the country's fishing industry.

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NEW ANTARCTIC EXPLORATION VESSEL

Moscow DOMESTIC SERVICE in Russian 28 Apr 86 2100 gmt

[Text] Finnish and Soviet specialists have started trials of the model of a new scientific expeditionary vessel, the "Akademik Fedorov." The strenghtened ice class diesel-electric will be used on voyages to the Antarctic. It will join the fleet of the Arctic and Antarctic Scientific Research Institute and will be registered at Leningrad. The vessel's dead-weight is almost 7,600 tons and the capacity of the main power machinery is about 22,500 hp; its sailing range is 20,000 miles. The vessel is fitted with 14 well-equipped laboratories.

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CSO: 1865/360-E

POLAR STATIONS MEASURE POLLUTION FROM EUROPE

Moscow TASS in English 23 Jun 86

[Text] Leningrad, 22 June. Sulfur dioxide from chimneys in Western Europe has been found on drifting ice floes in the Arctic Basin. This fact, registered by Soviet polar stations, was disclosed by Aleksandr Zaytzev, a deputy director of Leningrad's Main Geophysical Observatory, who met a TASS correspondent. The observatory, which used information of national services of several countries and international organizations, has completed summing up the results of monitoring of industrial sulfur emissions which are drifting across borders.

Clouds heavy with sulfur industrial waste are crossing European borders bringing toxic acid rains to places thousands of kilometers away from the pollution source. Firmly in the lead among such "exporters" are Britain and West Germany which annually release into the atmosphere 1.6 and 1.3 million tons of sulfur respectively. They are followed by France and Spain with an annual 200,000 tons.

According to data, the scientist continued, 180 to 395 million tons of sulfur are released into the atmosphere every year from natural sources. Its anthropogenic emissions account for 62 million tons, or 15-28% of the natural background, far higher than any of the industrial components.

"Sulfur emissions pose a special danger," Aleksandr Zaytzev stressed," "because they mainly affect the populated regions of continents." Half a million tons are "imported" every year to such countries as Austria, Portugal, Switzerland, Sweden, Norway, Finland, Czechoslovakia, Poland, Romania and Hungary.

Over its western border the USSR receives up to five million tons of sulfur compounds every year or an average 10 kilograms of sulfuric acid per hectare. To neutralize acid rains Soviet agrochemical services spend every year 3.5 million tons of lime, worth tens of millions of rubles, to chalk soil on an area of 60-70 million hectares.

Soviet experts hold the view that despite measures undertaken on a nationwide scale, sulfur emissions will increase as the share of coal in the fuel and energy balance becomes greater and the efficiency of alternative energy resources remains low. Therefore they favor international measures on monitoring industrial emissions.

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UDC 911.2;551.32

NEW DATA ON POSITION OF BELLINSGAUZEN GLACIER

Leningrad IZVESTIYA VSESOYUZNOGO GEOGRAFICHESKOGO OBSHCHESTVA in Russian
Vol 118, No 3, May-Jun 86 (manuscript received 30 Oct 85) pp 255-258

[Article by V.N. Yakovlev and A.D. Kovalev, Kaliningrad]

[Abstract] On an expedition in late 1979-early 1980 it was established that the mapped position of Bellinsgauzen Glacier does not correspond to its actual coordinates. The glacier is very dynamic and it is known that it changed repeatedly during the period 1938-1969. Between 1939 and 1955 the glacier advanced annually at a rate of 1.1 mile. By late 1981 it was evident that the glacier was undergoing a destruction process. That year the position of the remnant of Bellinsgauzen Glacier was plotted between the meridians 001°W and 000°20'E and 69°45'-69°48'S. The destruction of the glacier is confirmed by analysis of a "Meteor-4" photograph taken on 2 March 1981. A ship passing through the waters occupying the earlier position of the glacier discovered no seamounts or rises on the floor and sea depth was as great as 2,000 m. Bottom relief was greatly dissected and there were sharp rises and dips. Shipboard measurements of temperature, salinity and dissolved oxygen were made at the former location of the glacier. Hydroacoustic soundings were made which revealed presence of a sound-scattering layer at depths of 15-60 m. A map accompanying the text shows the present-day position of the glacier remnant. No changes were noted during the period 1981-1983. Figures 3; references: 3 Russian.

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UDC 911.9:502.7

ANTHROPOGENIC EFFECTS ON ARCTIC ATMOSPHERE

Leningrad IZVESTIYA VSESOYUZNOGO GEOGRAFICHESKOGO OBSHCHESTVA in Russian
Vol 118, No 3, May-Jun 86 (manuscript received 10 Jul 85) pp 193-202

[Article by K.Ya. Kondratyev, Leningrad]

[Abstract] Arctic air is pure in summer and polluted in winter. The winter pollution is attributable to increased effluent during winter, more intensive meridional circulation in winter and the greater time required for the precipitation of aerosol particles. The characteristic time required for the transport of polluted air into the Arctic is about 20 days. Arctic air frequently contains a great quantity of aerosol. The aerosol concentration in the Arctic atmosphere was high in winter at all places where measurements were made. The indicator of an anthropogenic origin of this aerosol is an increased concentration of V, Mn, Pb, Zn and SO_4 exceeding the levels corresponding to natural sources. The existence of such a great volume of absorbing aerosol in the Arctic may exert an effect on climate, either directly or indirectly. A change in snow cover albedo may occur due to the settling of aerosol particles on its surface. The dominant factor in the transport of aerosol from the temperate latitudes into the Arctic for a distance of 5,000-10,000 km is not ordered convection, but macroscale turbulent diffusion. The spatial distribution of aerosol in the Arctic should be uniform with characteristic scales of more than 2,000 km, exceeding the dimensions of Arctic cyclones. The most important natural source of aerosol in the Arctic is the deserts of central Asia. In the Arctic troposphere there are aerosol clouds and layers up to the tropopause level. These is a strong variability of the vertical profile of aerosol content with time in the troposphere and a relatively weak variability of background aerosol in the stratosphere. During winter the entire Arctic is subject to the influence of aerosol pollution from distant regions. Sulfates are the most important of these pollutants, with organic compounds in second place. References 51: 7 Russian, 44 Western.

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CSO: 1865/357

UDC 911.2:551.326/268

SOME PATTERNS IN ARCTIC BASIN ICE THICKNESS DISTRIBUTION

Leningrad IZVESTIYA VSESOYUZNOGO GEOGRAFICHESKOGO OBSHCHESTVA in Russian
Vol 118, No 3, May-Jun 86 (manuscript received 2 Sep 85) pp 202-207

[Article by Ye.U. Mironov, Leningrad]

[Abstract] An improved method was developed for computing ice thickness distribution in the Arctic with allowance for hummocking and clarification of the principal patterns of its spatial and seasonal variability. On the basis of the determined areas and thicknesses of perennial, two- and one-year ice it was possible to calculate generalized ice thicknesses for the Arctic Basin and Arctic seas (Kara, Laptev, East Siberian, Chukchi, Beaufort, Lincoln). Histograms of ice thickness were constructed for analysis of spatial variability. A table gives the mean weighted thickness of Arctic Basin ice with allowance for hummocking for spring determined by different authors (all estimates are extremely close). The seasonal changes of generalized ice thickness in Arctic seas is greater than in the Arctic Basin, attributable primarily to considerable summer thawing in coastal regions and the great winter build-up of one-year ice which predominates in Arctic seas. The minimum seasonal changes in ice thickness occur in the Eurasian part of the Arctic Basin, whereas the maximum thickness occur in the Eurasian part of the Arctic Basin, whereas the maximum thicknesses and least summer thawing occur in its Canadian part. As a result of greater hummocking there is an increase in seasonal changes in ice thickness in the Canadian part of the Arctic Basin and in the Kara and Chukchi Seas, where the thickness of even ice is considerably less than in the seas of the central part of the Arctic. Figures 2; references 15: 9 Russian, 6 Western.

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